A FAWCETT PUBLICATION

AUGUST
NSC

MECHANIX ILLUSTRATED

FORMERLY MODERN MECHANIX

15¢

SECRETS OF THE CIRCUS ENGINEERS!

Get acquainted with our PHOTOGRAPHY SECTION · Page 119

AUGUST 1938
MECHANIX ILLUSTRATED
15 CENTS

NOW! Anyone without experience can do a thousand and one REPAIR JOBS!

WELDING · BRAZING · SOLDERING

Quickly · Perfectly · Easily

with the NEWLY INVENTED 3 IN 1 Electric TORCH

COMPLETE WITH POWER UNIT
WORKS OFF 110 VOLT AC OR DC LIGHT CIRCUIT

Here at last is a portable machine that does real welding, brazing and soldering, yet is priced within the reach of all. The 3 in 1 comes to you complete with goggles, carbons, various types of welding rod and all accessories needed to do various repair jobs. It is all ready to plug in a light socket—nothing extra to buy. Simple instructions make it possible for you to do first class work without any previous experience or mechanical skill. The 3 in 1 instantly creates a terrific flame by just touching the carbons together. No necessity of knowing how to strike an arc. Easy to handle—nothing dangerous about it—cannot short circuit. Does any number of first class repair jobs.

REPAIRS FENDERS, AUTO BODIES, TANKS, PIPES, BICYCLES, RADIOS, ETC.

With the 3 in 1, you will be able to do a professional type of work irrespective of whether you have had any experience. You will be able to do first class fender weld jobs. The 3 in 1 is ideal for auto body repairs—steam fitters, plumbers, sheet metal shops, engineers, maintenance men and janitors will find it indispensable. Bicycle and radio repair men can find many uses for it. By following simple instructions, heavy work such as bumpers, cylinders, tanks and industrial repairs can be done. It is ideal for the man who does his own repairing. There are countless jobs around a home or farm that can be done easily and well.

WORKS ON ALUMINUM, BRASS, COPPER, IRON, STEEL AND OTHER METALS

With the 3 in 1 Electric Torch you are not limited to repairs on any one type of work. The outfit comes to you complete with various kinds of rod, even including aluminum. The 3 in 1 does exceptionally fine work on aluminum, excelling that of many much higher priced welding outfits.

10 DAY HOME TRIAL OFFER

You can actually have a 3 in 1 Electric Torch in your possession to use and test on different jobs for 10 full days entirely at our risk. Could anything be fairer? We don't ask you to take our word for it. Instead, we ask you to see for yourself.

AGENTS! There is big money in introducing the 3 in 1 Electric Torch to the many places that have an absolute need for it. You will find quick easy sales waiting for you in repair shops, garages, factories, sheet metal, radio and bicycle repair shops, and many other places. Write at once for free particulars and learn how you can get your own 3 in 1 Electric Torch absolutely free for demonstration purposes by helping to introduce it to others. Send coupon today.

Electro-Torch Co. 2613-AK Michigan Ave. Chicago, Ill.

ELECTRO-TORCH CO.
2613-AK Michigan Ave.
Chicago, Ill.

Gentlemen:

☐ Without any obligation on my part you may tell me how I can try a 3 in 1 Electric Torch for 10 days entirely at your risk.

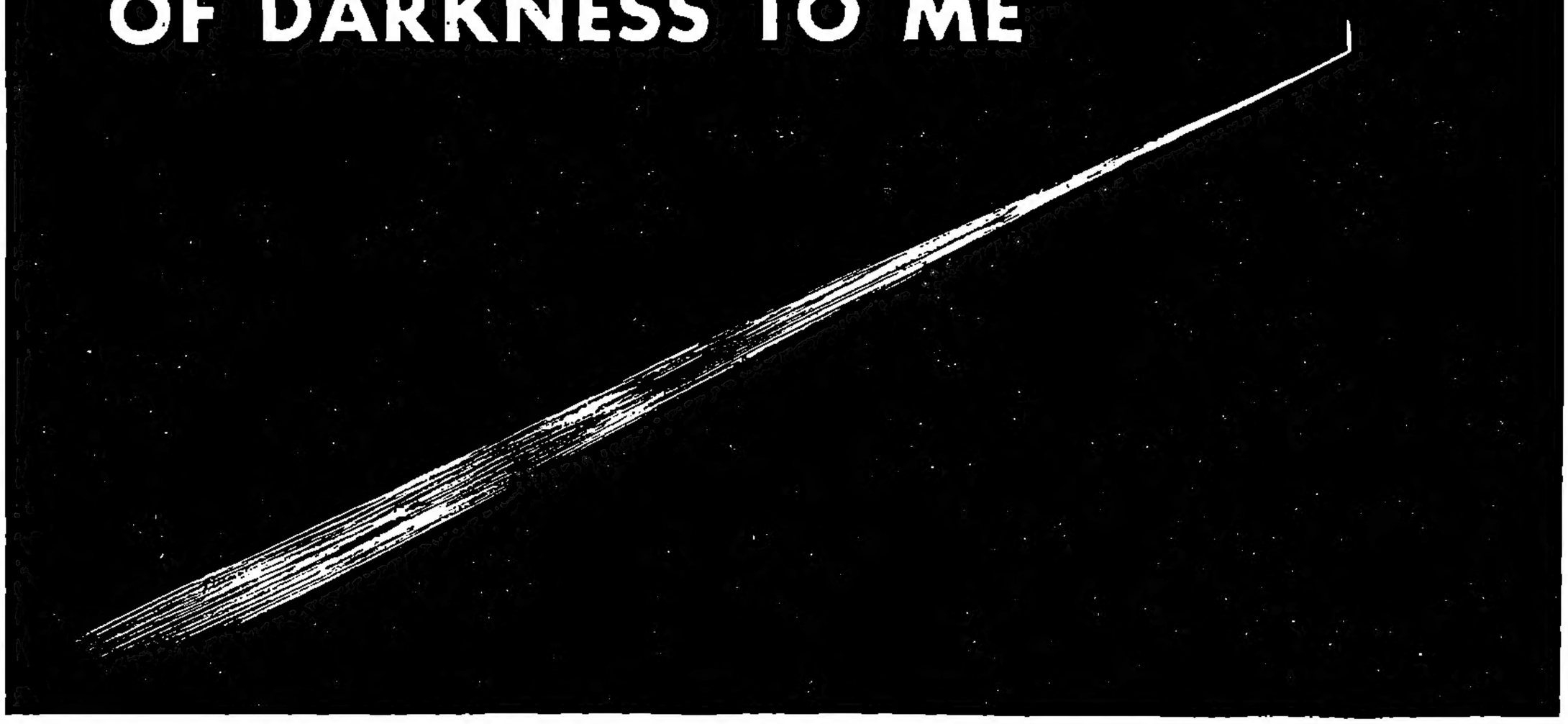
☐ I am interested in your agents offer. Give me full particulars of your big profit plan and tell me how I may have a 3 in 1 Electric Torch for demonstration purposes by helping introduce it to others.

NAME _____

ADDRESS _____

CITY_____ STATE_____

"IT WAS LIGHT IN A WILDERNESS OF DARKNESS TO ME"



"I WAS STUCK. A wife and three kiddies—and the same old pay envelope. I couldn't see a thing ahead except the same old grind. Then one day I read an I. C. S. ad. The coupon fascinated me. A new idea struck me—it was a light in a wilderness of darkness to me! Today, because I mailed that coupon two years ago, I am a trained man—making a trained man's pay!"

Does this suggest something to you? Then mail the coupon today!

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 2322-Q, SCRANTON, PENNA.

★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X: ★

TECHNICAL AND INDUSTRIAL COURSES

☐ Architect	☐ Sheet Metal Worker	☐ Commercial Refrigeration	☐ Surveying and Mapping
☐ Architectural Draftsman	☐ Boilermaker	☐ Plumbing ☐ Steam Fitting	☐ Bridge Engineer
☐ Building Estimating	☐ Telegraph Engineer	☐ Heating ☐ Ventilation	☐ Bridge and Building Foreman
☐ Contractor and Builder	☐ Telephone Work ☐ Radio	☐ Air Conditioning and Cooling	☐ Chemistry ☐ Pharmacy
☐ Structural Draftsman	☐ Mechanical Engineering	☐ Steam Engineer	☐ Coal Mining
☐ Structural Engineer	☐ Mechanical Draftsman	☐ Steam Electric Engineer	☐ Mine Foreman ☐ Fire Bosses
☐ Management of Inventions	☐ Machinist ☐ Toolmaker	☐ Marine Engineer	☐ Navigation
☐ Electrical Engineer	☐ Patternmaker	☐ R. R. Locomotives	☐ Cotton Manufacturing
☐ Electric Lighting	☐ Diesel Engines	☐ R. R. Section Foreman	☐ Woolen Manufacturing
☐ Welding, Electric and Gas	☐ Aviation Engines	☐ Air Brakes ☐ R. R. Signalmen	☐ Agriculture
☐ Reading Shop Blueprints	☐ Auto Technician	☐ Highway Engineering	☐ Fruit Growing
☐ Heat Treatment of Metals	☐ Auto Electrical Technician	☐ Civil Engineering	☐ Poultry Farming

BUSINESS TRAINING COURSES

☐ Business Management	☐ Bookkeeping	☐ Service Station Salesmanship	☐ Grade School Subjects
☐ Industrial Management	☐ Secretarial Work	☐ First Year College Subjects	☐ High School Subjects
☐ Traffic Management	☐ Spanish	☐ Business Correspondence	☐ College Preparatory
☐ Accountancy	☑ French	☐ Stenography and Typing	☐ Illustrating
☐ Cost Accountant	☐ Salesmanship	☐ Civil Service ☐ Mail Carrier	☐ Cartooning
☐ C. P. Accountant	☐ Advertising	☐ Railway Mail Clerk	☐ Lettering Show Cards ☐ Signs

DOMESTIC SCIENCE COURSES

☐ Home Dressmaking	☐ Advanced Dressmaking
☐ Professional Dressmaking and Designing	☐ Foods and Cookery
	☐ Tea Room and Cafeteria Management, Catering

Name.....*Age*.....*Address*.....

City.....*State*.....*Present Position*.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

PRICE
15 CENTS

SAME PRICE
IN CANADA

MECHANIX ILLUSTRATED

FORMERLY MODERN MECHANIX

AUGUST
1938

Volume XX
Number 4

Circulation over 250,000

Copyright 1938 by Fawcett Publications, Inc.

SPECIAL FEATURES

Secrets Of The Circus Engineers - - - - 35
By F. Beverly Kelley

10,000 Miles An Hour! - - - - - - - - 46
By Allan Finn

Giant Pictures From Pigmy Prints - - - - 52
By H. H. Slawson

Mile A Minute Safety - - - - - - - - 58
By Robert W. Gordon

Can Amateur Flying Come Back? - - - - 70
By Lieut. R. H. Rankin

Nature Photography Around The Year - - - 74
By Percy A. Morris

MI Readers' Service Bureau - - - - - - 80

The American Flag On Stamps - - - - 86
By Montgomery Mulford

(Continued on page 6)

COVER SUBJECT: Felix Adler, world famous circus clown, photographed in color by Maxwell Frederick Coplan.

MECHANIX ILLUSTRATED is not a new magazine. It is the former MODERN MECHANIX in new dress, with more pages, more and bigger pictures, more human-interest articles, more craft and hobby projects than ever before. New readers will quickly see that MECHANIX ILLUSTRATED is fresh, lively, entertaining. Old readers already know that it is accurate, authoritative, inspiring.

Show this copy of MECHANIX ILLUSTRATED to your friends and tell them to look for future issues on their local newsstands. Be sure to say MECHANIX ILLUSTRATED to your newsdealer, and you will get the biggest 15 cents worth of magazine on the market!

Camera Section

$50 For One Picture! - - - 68
Winners Of Photo Awards - 119
Keep A Record - - - - 120
Tank Developing Simplified - 121
Two-Way Darkroom Light - 124
Light Proof Paper Box - - 124
Variable Level Print Bath - 124
Motor Operated Drier - - 125
Photo Kinks - - - - - 126
Adjustable Enlarger Easel - 128
Waterproof Camera Case - - 130
Amateur Photo Puzzlers - - 132

Published monthly by Fawcett Publications, Inc., 11th Street and Broadway, Louisville, Kentucky. Executive Office—22 W. Putnam Avenue, Greenwich, Connecticut. Editorial and Advertising offices—1501 Broadway, New York, New York. Send subscriptions to the Louisville, Kentucky, or Greenwich, Connecticut, addresses.

Entered as second-class matter under the Act of March 3, 1879, at the post office in Louisville, Ky., with additional entry at Greenwich, Conn. Not responsible for unsolicited manuscripts. In U. S. and Possessions and in Canada, 15c a copy; $1.50 a year. Other Postal Unions, $2.00 a year. East Indian Agent, P. C. Eranee Sons, Bombay, India. Printed in U. S. A. Advertising forms close the first of second month preceding date of issue. Advertising offices: New York, 1501 Broadway; Chicago, 360 N. Michigan Ave.; San Francisco, Simpson-Reilly, 1014 Russ Bldg.; Los Angeles, Simpson-Reilly, Garfield Bldg. Member Audit Bureau of Circulation.

W. H. FAWCETT, Publisher RALPH DAIGH, Managing Editor ROBERT HERTZBERG, Editor AL ALLARD, Art Director
JOHN L. SCHERER, CLIFFORD PETERS, STANLEY GERSTIN, Associate Editors S. S. RABL, Naval Consultant

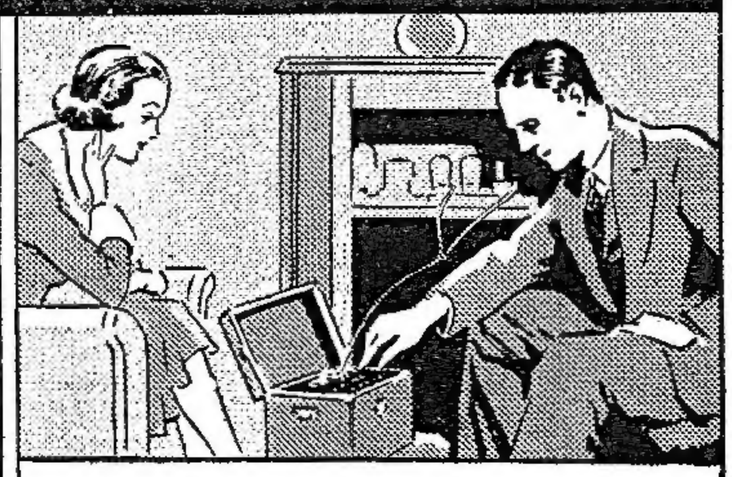
I jumped from $18 a week to $50
-- a Free Book started me toward this
GOOD PAY IN RADIO

HERE'S How it Happened

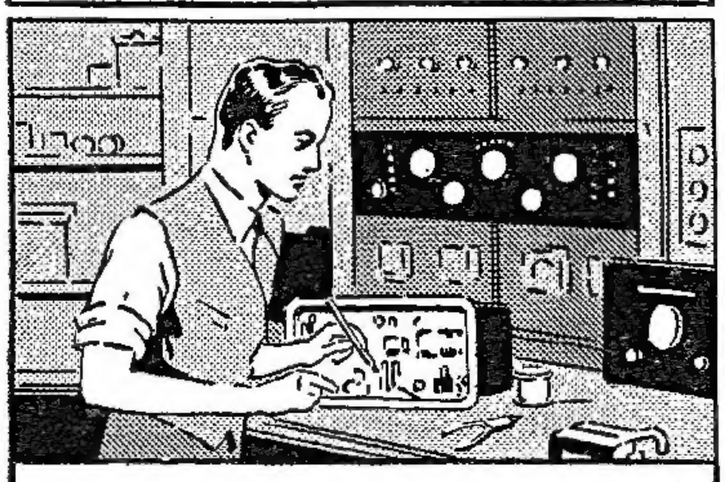
by S. J. E.

(NAME AND ADDRESS SENT UPON REQUEST)

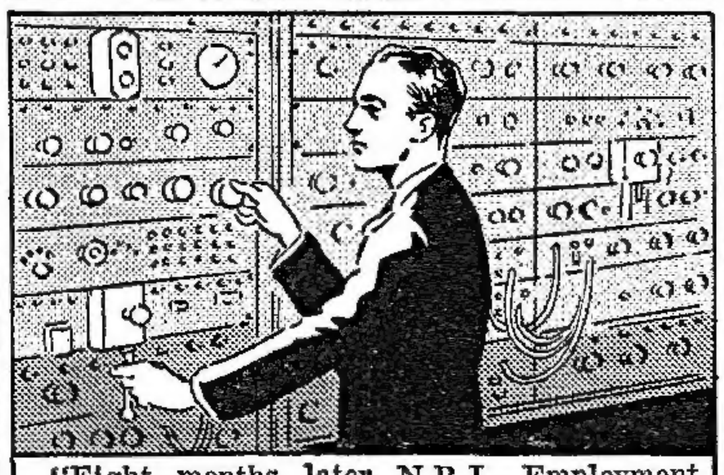
"I had an $18 a week job in a shoe factory. I'd probably be at it today if I hadn't read about the opportunities in Radio and started training at home for them."



"The training National Radio Institute gave me was so practical I was soon ready to make $5, $10, $15 a week in spare time servicing Radio sets."



"When I finished training I accepted a job as serviceman with a Radio store. In 3 weeks I was made service manager at more than twice what I earned in the shoe factory."



"Eight months later N.R.I. Employment Department sent me to Station KWCR as a Radio operator. Now I am Radio Engineer at Station WSUI. I am also connected with Television Station W9XK."

"N.R.I. Training took me out of a low-pay shoe factory job and put me into Radio at good pay. Radio is growing fast. The field is wide open to properly trained men."

J. E. SMITH, President
National Radio Institute
Established 1914

Find out today how I Train You at Home to BE A RADIO EXPERT

Many Make $30, $50, $75 a Week

Do you too want a better job? Do you too want to make more money? Radio offers many spare time and full time opportunities for good pay.

Get Ready Now for Jobs Like These

Broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays many $200 to $500 a year—full time servicing jobs pay many $30, $50, $75 a week. Many Radio Experts are operating full or part time Radio businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay, see the world. Automobile, police, aviation, commercial Radio, loud speaker systems, offer good opportunities now and for the future. Television promises good jobs soon. Men I trained have good jobs in these branches of Radio.

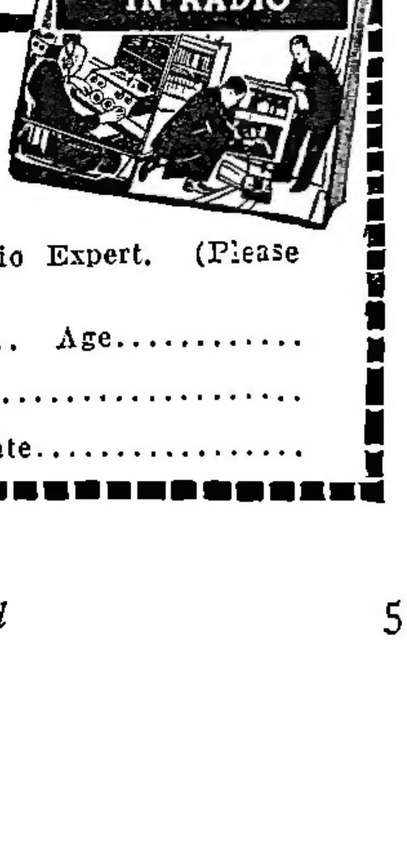
Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

Almost every neighborhood needs a good spare time serviceman. The day you enroll I start sending Extra Money Job Sheets showing how to do Radio repair jobs. Throughout your training I send plans and ideas that made good spare time money for hundreds. I send Special Equipment to conduct experiments, build circuits, get practical experience. I ALSO GIVE YOU A COMPLETE, MODERN, PROFESSIONAL ALL-WAVE ALL-PURPOSE RADIO SET SERVICING INSTRUMENT TO HELP SERVICE SETS QUICKER—SAVE TIME, MAKE MORE MONEY.

Find Out What Radio Offers You

Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities, also those coming in Television; tells about my Training in Radio and Television; shows you 131 letters from men I trained, shows what they are doing, earning; shows my Money Back Agreement. MAIL COUPON in an envelope, or paste on penny post card—NOW!

J. E. SMITH
President, Dept. 8HH
National Radio Institute
Washington, D. C.



J. E. SMITH, President, Dept. 8HH
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out spare time and full time opportunities in Radio, and explains your practical method of training at home in spare time to become a Radio Expert. (Please write plainly.)

Name..... Age.....

Address .....

City..... State.....

WHAT TO DO With Your INVENTION?

Free Books TELL ALL!

Patent facts clearly explained. Everything you need to know about protecting and commercializing your ideas. Mail coupon below for free copies of our booklets, "How We Protect You" and "Suggestions on How to Commercialize Your Invention". We will also enclose our original Certification of Invention form, valuable proof in showing priority.

OUR 63 YEARS' EXPERIENCE

is your assurance that you are dealing with a reliable firm of registered patent attorneys. We are ready to serve you quickly, efficiently, confidentially.

C.A. SNOW & CO. *Registered Patent Attorneys Since 1875* — FREE FACTS FOR YOU!

Dept. 388, Snow Building, Washington, D. C.

Gentlemen: Please send me absolutely free and without obligation on my part, your original document, "Certification of Invention," together with your two guides for inventors, "How We Protect You" and "Suggestions on How to Commercialize Your Invention."

Name .....

Street and No. .....

City or Town..... State.....

INVENTORS
BE SUCCESSFUL

DIARY OF INVENTION. When you have little money do you know how to protect your invention? This diary is a pocket size book for keeping a diary record to protect your priority rights. Price 25c.

INVENTION & FINANCE MAGAZINE is written for intelligent inventors who are willing to earnestly work for success. Two year subscription $1.00 entered upon promise to pay on receipt of first copy.

PLACE YOUR ORDER by checking item you desire. Then cut out and mail this advertisement.

☐ Send subscription ☐ Send Diary

INVENTION & FINANCE MAGAZINE
80-H Wall Street, New York, N. Y.

PATENTS
PERSONAL SERVICE

My *Personal* service assures strictest confidence on all your patent problems. Send me a model or drawing, or sketch and description of your invention, and $5.00. I will make a search and report promptly as to its patentability and send you a copy of my 72-page booklet. Or, if you prefer to read my booklet first, write today for FREE copy. Registered Patent Attorney.

L. F. Randolph, 761 Victor Building, Washington, D. C.

LeJay Electric Troller
LIGHTWEIGHT—CLEAN—SILENT

Ideal for boats or canoes because of its variable speed from maximum to just moving. So simple a child can operate yet strong and sturdy for general use. Operates 8-12 hours on good battery. Silent operation plus use of both hands for fishing and other features make it the perfect outboard. Free Details.

$29.50

It's easy to **build your own electric outboard** from old auto generator. We show you how. Dime brings simplified plans and valuable catalog.

LEJAY MFG. CO., 514 LeJay Bldg.
Minneapolis, Minn.

CONTENTS—Continued from page 4

SHORTER FEATURES

Upside-Down Dam Conquers Flood - - - 42
Building The Navy's Big Guns - - - - 44
(MI's "Book Of The Month") - - - - - 74
New Life For Old Bones - - - - - - 79
Laboratory "Tortures" Cars - - - - - 85

HOW-TO-BUILD FEATURES

Landlubber's Shuffleboard - - - - - - 87
Build This Simplified Canvas Kayak - - - 98
Build This XP-3 Gas-Powered Model Airplane - - - - - - - - - - - - 108
Build This Practical Garden Barrow - - - 118

FOR THE WORKSHOP FAN

How To Make Electromagnets - - - - - 102
Kinks Save Time In Shop - - - - - - 106
Kinks Simplify Shop Tasks - - - - - - 113

CAMPING AND OUTDOORS

First Aid For The Sportsman - - - - - 92
How To Moor The Small Boat - - - - - 114

HOME AND GARDEN

How Plain Is Your House Number? - - - 88
Kinks Simplify Household Tasks - - - - 91
Spice Your Lawn With Distinctive Novelties - 100
Add A Sun Room - - - - - - - - - - 107
Simple Plumbing Repairs - - - - - - 116

AUTOMOTIVE

Home-Built "Autoboat" Operates On Water Or Land - - - - - - - - - - - - - 51
Ventilator Makes Auto Trunk "Home" For Pets - - - - - - - - - - - - - - 66
Fire Truck Goes Streamline - - - - - 76
Gauges Check Load On Axle - - - - - 78
Time Saving Auto Kinks - - - - - - 117

AVIATION

Lightweight Plane Has Folding Wings - - 41
New Tailless Plane May Be Valuable War Weapon - - - - - - - - - - - - 43
Sets New Sailplane Record - - - - - - 45
"Gas-Powered" Flying Models Provide Thrills - - - - - - - - - - - - - 50
U. S. Rehearses First Air War "Blackout" - 56
"Turtle-Back" Cockpit Speeds Handling Of Machine Gun - - - - - - - - - - 64
Seek Aero Fire Data - - - - - - - - 66
Flies 2,000 Feet In Hang-Type Glider - - 67
"Flying Bomb" Guided By Man Pilot - - 73
English Plane Has Largest Retractable Wheel Gear - - - - - - - - - - 84

[*Continued on page 8*]

INVENTORS *Get* FREE COPY

COMPLETE INFORMATION ON HOW TO OBTAIN PATENT AND MARKET INVENTIONS

If you have ideas, if you have invented something, if you're interested in inventing something, you need this new **48-page book** that gives the entire Story of Patents. It tells you for the first time about new phases of invention, how others succeeded, how the patent laws protect you, how to market your invention, where to obtain finances, how to form a company, partnership, or arrange for royalties from your invention's sale.

NEW INFORMATION

This book gives you actual statements, suggestions, and ideas from famous authorities who know the inventive field thoroughly.

PRACTICAL BENEFITS

You will find 6 complete pages illustrated with simple inventions that have succeeded in six different fields of industry. Over 100 illustrations are in this book. You will read the stories of ten (illustrated) of America's most famous inventors. You will find an experienced and thorough survey of market conditions affecting the inventor—showing the possibilities for commercial invention today. Entire chapters are devoted to the value of a patent in promoting the final success of your invention. The importance of quick action in applying for patent is stressed—facts revealing danger of delay are emphasized.

If you expect to realize profits from your invention you must protect it with a U. S. Patent. Otherwise you may find that all your time and labor have been lost, because it often happens that other inventors are working on the same idea. If you have an idea, an invention, or an ambition to invent—get the information on obtaining patent AT ONCE!

WHAT A PATENT DOES FOR YOU

Without a U. S. Patent, you cannot expect to reap the profits that your invention may make possible. Send at once for this book. After you get that, you'll know exactly what to do to protect yourself. Anything you write us or send us is strictly confidential between us. All letters and drawings are kept in strong, steel, fire-proof files, which are open only to us or authorized members of our staff. We have secured patents for inventors located in every State in the Union. The practice of our organization is confined entirely to Patents, Trademarks and Copyrights. We have had years of experience in Patent Matters. When you place your idea in our hands, we are in position to proceed at once to secure protection for you. Our fees are reasonable, and if you desire, we can arrange convenient terms of payment.

Get This FREE BOOK

IMMEDIATELY MAIL COUPON TODAY!

This new **48-page book** of facts is absolutely FREE! You need it NOW. Simply fill out the coupon, and mail. The field of invention changes constantly—here is the latest information on the most recent developments affecting inventive success. Within a very few days you will receive our Free Book, together with the Record of Invention Blank described here. Write NOW—**Clarence A. O'Brien and Hyman Berman,** Registered Patent Attorneys in U. S. Patent Office, 317-F Adams Building, Washington, D. C.

CLARENCE A. O'BRIEN and HYMAN BERMAN

317-F Adams Building, Washington, D. C.

Registered Patent Attorneys Before U. S. Patent Office

Please send me at once your Big Free 48-Page Book, "Patent Guide for the Inventor" and your specially prepared "Record of Invention" form. This request does not obligate me.

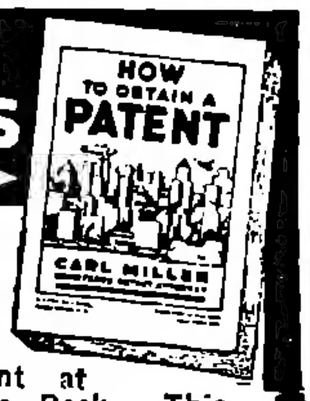
Name .....

Address .....

.....

(Please write or print plainly)

INVENTORS
PATENT YOUR IDEAS
SEND FOR FREE BOOK



HOW TO OBTAIN A PATENT

Written by a Former Member of the Examining Corps (1922-24) of the U. S. Patent Office. If you want to profit by your idea, you should take steps to apply for a U. S. Patent at once. Your first step is to get this Free Book. This interesting illustrated book contains valuable information you should have. It tells you fully how to obtain a patent on your idea in the quickest way. With this Free Book you will also receive a "Record of Invention" form on which you can easily record your idea. Personal and Confidential Service: Your case will be personally handled only by a Registered Patent Attorney who is also a Former Member of the Examining Corps of the U. S. Patent Office. All communications confidential.

MAIL COUPON TODAY for FREE PATENT BOOK and RECORD OF INVENTION Form

CARL MILLER
REGISTERED PATENT ATTORNEY
FORMER MEMBER EXAMINING CORPS U. S. PATENT OFFICE

Woolworth Bldg., 35th Floor, Dept. 88B, New York City
MILLER BUILDING, Dept. 88B, WASHINGTON, D.C.
Please send me your Free Book, "How to Obtain a Patent," and your "Record of Invention" form.

NAME .....

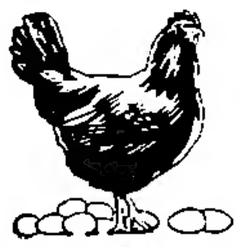
ADDRESS .....

ELECTRICAL ENGINEERING
ONE YEAR CONDENSED COURSE

Prepares for technical work in the electrical field. Thorough training in principles, with practical applications in laboratory and shop. High placement record. Modern buildings, dormitory, dining hall. Campus. 46th year begins Sept. 28. Catalog on request.

BLISS ELECTRICAL SCHOOL
298 Takoma Ave., Washington, D.C.

RAISE POULTRY
FOR PROFIT



START AT HOME. MARKET WAITING. Well-located garage, barn, or backyard all that is needed. Learn latest methods from our Home Study Course and put cash in your pockets every day. We train you, help you. Get facts about our unusual offer NOW! Men and women making money in every state—in cities and towns as well as in the country—using my methods. Send for Illustrated FREE 32-PAGE BOOK today!

NATIONAL POULTRY INSTITUTE
Dept. 134-D Adams Center, N. Y.

9"x3' SOUTH BEND LATHE
New Low Terms
ONLY $6.00 A MONTH
Ask for FREE Catalog

$85 LESS MOTOR DRIVE

WRITE for details on this new 9" x 3' Workshop Precision Lathe, back geared, screw cutting. Made in 8 different drives, 4 bed lengths, 38 practical attachments available for use with this lathe. Weight 320 lbs. crated. **Ask for catalog 15K—sent Free, Postpaid.**

SOUTH BEND LATHE WORKS
270 E. Madison Street South Bend, Indiana, U. S. A.

CONTENTS—Continued from page 6

NEW MECHANICAL DEVICES

"Soil-Soaker" Device Aids Gardeners - - 40
Metal Diving Suit Developed - - - - - - 64
Plowing Machine Creates "Dams" To Hold Rainfall - - - - - - - - - - - - - 66
"Laundry" Washes Bus In One Minute - - 67
Machine Analyzes Air "Breathed" By Bridge 69
New Motorcycle Sidecar Mounting Speeds Turns - - - - - - - - - - - - - 76
Hand Tool Gives 5-Ton Force - - - - - 76
Device Tests Liveliness Of Baseballs - - - 77
Powered Wheel Chair Goes 25 M. P. H. - - 77
Probability Device Gives Exact Odds - - 78
Novel Propellers Eliminate Rudder On Ferry Boat - - - - - - - - - - - - - 83
Device Tests Tone Of Musical Instruments - 83
Builds Novel "Automobile" - - - - - - 84

RADIO AND ELECTRICITY

Battery-Operated Hearing Aid Is Easily Concealed - - - - - - - - - - - - - 57
Machine Registers Votes Electrically - - - 57
The Twin Triode Regenoflex - - - - - - 96

DEPARTMENTS

Chips From The Editor's Workbench - - - 10
Nic Sprank's Oddities - - - - - - - - - 34
Crafts And Hobbies - - - - - - - - - - 87
Photography Section—Prize Photo Awards - 119

MISCELLANEOUS

Reflector Buttons Light Up Michigan Highway - - - - - - - - - - - - - - 40
College Students Show Model Handicraft - 40
Chemical Process Improves Coal - - - - 41
Home-Built Bicycle Has "Rumble Seat" - - 41
Ventriloquist's Dummy Gets Mechanical Legs - - - - - - - - - - - - - - 45
Tank Car Sections Serve As Storage Houses For Paints - - - - - - - - - - - - 51
Boat Models Built Of Wood Blocks - - - 51
River Boat Boasts Air Conditioning - - - 57
Inert Gas Protects Fuel Tank Welder - - 64
Farmer Devises Novel Way To Remove Weeds - - - - - - - - - - - - - - 65
Restaurant Novelty Amuses Patrons - - - 65
Special Tires Assist Tractor - - - - - - 65
Youth Claims Discovery Of Artificial Radium - - - - - - - - - - - - - - 67
Mask Protects Worker Against Silicosis - - 69
Builds Summer Home Around Tree Trunk - 69
Life Preserver Blows Itself Up - - - - - 77
New Game Uses Wooden Foils - - - - - 78
Biggest Chain Built For Cable Ship - - - 82
Relief Map Shows Earth's Curve - - - - 82
Car Hauls Hot Copper - - - - - - - - - 83
Wading Outfit Lets Fisherman Float - - - 84

Accept No Substitutes! Always Insist on the Advertised Brand!

How *dare* you say, "I have no opportunity"

C. E. VETH

Gets SACCO products on the way to customers for less money . . .

B. J. MERTZ

Not content, he, to remain a teacher at low pay . .

—when men and women, thru the new home-study training, are making records such as these?

YOU seek a better opportunity to get ahead in business—and you don't want "promises"; you want a definite program for advancement, backed by positive proof that that program *works!*

Listen, then, to these actual experiences —and when you have heard them, tell us, if you can, how you *dare* to say, "I have no opportunity!"

Earns Raises Totalling 324%

Take the case of C. E. Veth, holding a good job as traffic manager. Many a man would have rested content. Not Veth! Not while it was possible to keep right on moving up in his firm—the Smith Agricultural Chemical Co. of Columbus and Indianapolis. Note what Veth did:

"How," he asked himself, "can I get *more* money? What will *make* me worth more to them? I'm already giving them full value in time and hard work. But if only I could . . ."

And then he saw the way! *He would save them so much money that they could easily give him a fine raise yet still be money ahead!*

So, Mr. Veth watched for ways to do it. He found a few. But his knowledge of the possibilities was limited. At length, a day came when he realized that he needed to *know* more before he could *earn* more. That day he sent us just such a coupon as *you* see on this page!

What happened? In a single year he detected $10,600 worth of mistakes in charges that his LaSalle training enabled him to correct—to *save* for his firm. Yes, he got his raise. And another. And still others. *324% at latest report to us.*

700% Increase in 7 Years

From teacher in a rural Texas school to foundry Office Manager and Acting Secretary *in four years*—at a salary *five times* his former one! And in three years more, B. J. Mertz had become Comptroller and a Director in the Buckeye Union Casualty Co. with *a yearly income 700% greater* than when he mailed the LaSalle coupon. Higher accountancy *training* did it for Mr. Mertz —yes, training plus the *backbone* to get out of an ill-paid rut into the "big time."

BERNICE ROACH

No single diploma would satisfy when several would win bigger success . . .

Women, Too, Increase Their Success

For instance, Miss Bernice Roach! Already well paid, she nevertheless *doubled* her income, *quickly*—three months after winning her LaSalle diploma and passing her Certified Public Accountant's examination! "A lucky day for me," she says of the day she enrolled for LaSalle accountancy. Yet what she did, others can do—and *are* doing!

Send for These Free Books

You, too, are eager to get ahead? Then you will find it of vital importance to learn more of the success-methods which Veth, Mertz, Miss Roach and many others have employed so profitably.

We have therefore prepared a special 64-page book which outlines these methods in detail. It also points out the big opportunities in the field you are in or wish to enter—shows you how you may fit yourself to *grasp* them!

The coupon brings this book to you without cost or obligation.

Measure your will to succeed by what you **do** with this coupon—NOW!

LASALLE EXTENSION
Dept. 8493-R Chicago

I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked below.

- ☐ Higher Accountancy
- ☐ Business Management
- ☐ Modern Salesmanship
- ☐ Traffic Management
- ☐ Law: Degree of LL. B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Business Correspondence
- ☐ Stenotypy
- ☐ Credit and Collection Correspondence
- ☐ Modern Foremanship
- ☐ Expert Bookkeeping
- ☐ C. P. A. Coaching
- ☐ Business English
- ☐ Effective Speaking
- ☐ Office Management

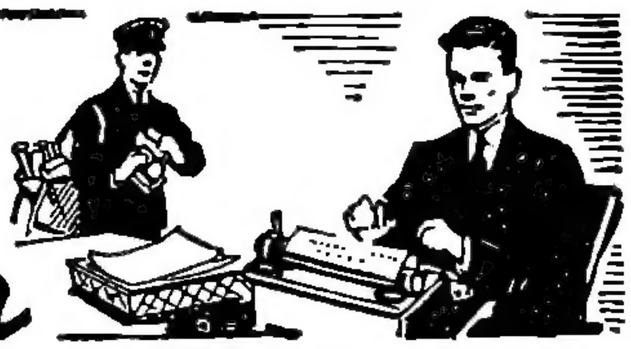
Name ---------- Age ----------

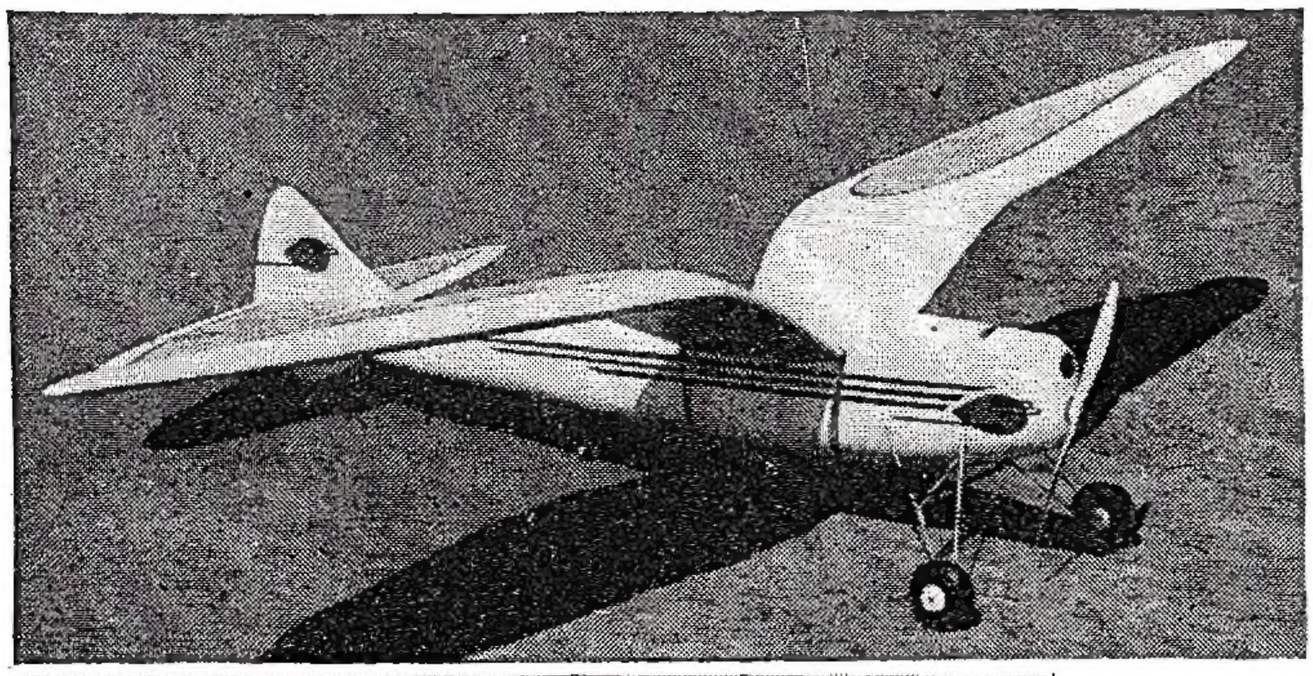
Present Position ----------

Address ----------

LaSalle Extension Adult Business Training

Chips from the Editor's Workbench





Beautiful to look at and a good flier, too, is this nine-foot gull-wing "gas" model constructed by Edward Berton.

CAST your eyes on the two photos above, which show Edward Berton, of Brooklyn, N. Y., with the gull-wing "gas" model airplane he constructed. Plenty of time and effort went into the building of Ed's "putt-putt" and I think every contributor to the Workbench will agree that he deserves the $5 prize sent to him by MI.

I had the privilege of inspecting the model and you can take it from me that it shows expert craftsmanship and boasts the best finish I have ever seen on a flying model. The model is powered by a miniature gasoline engine of one-third horsepower and, according to Ed, has already made eight successful flights. The wingspan is nine feet and the fuselage length is 62 inches. Maybe, if enough MI readers show interest, I can arrange with Ed to prepare plans and a how-to-build article on his model. How does that strike you fellows who have been bitten by the "gas" model bug?

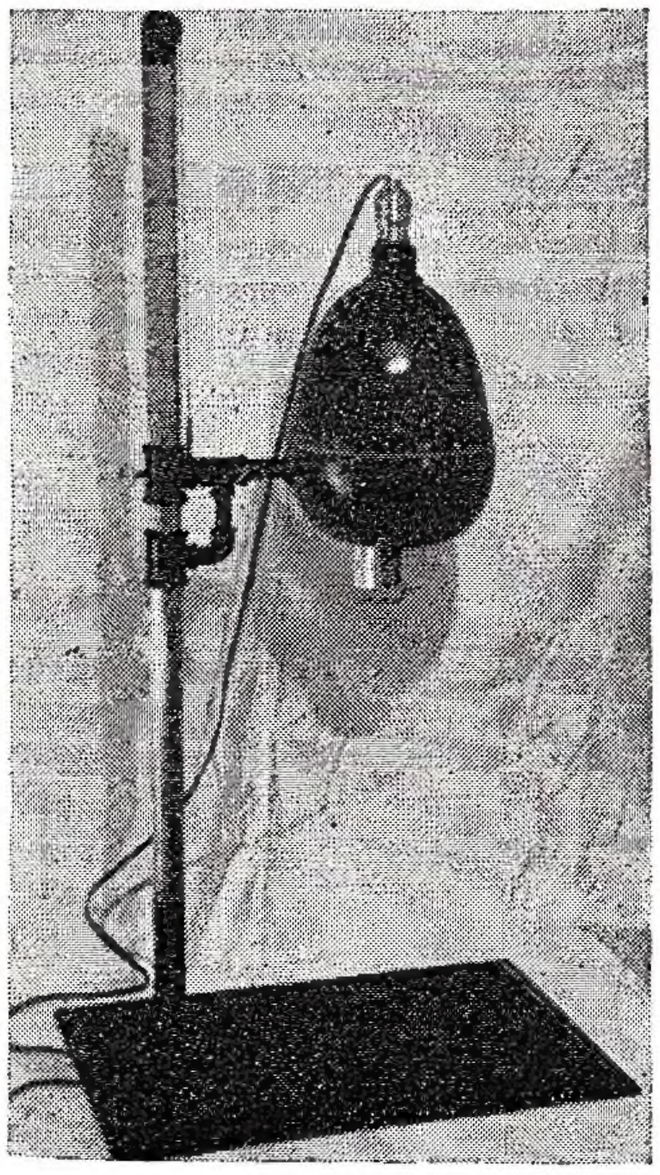
***

From Jimmie Lee Jackson, of Neff, Ohio, I received a letter asking me to put him in touch with MI readers who are interested in stamp collecting. Jim shows real interest in the hobby, so why not contact him if you want to swap letters and stamps?

***

The photo enlarger plans which appeared in our March, 1938 issue certainly "clicked" with MI photo fans, judging from the numerous letters and photos I have received. Best of the enlarger photos sent in this month was one received from Victor Olson, of Minneapolis, Minn., who scored a $3 award. Vic says he had to change the design of the enlarger slightly in order to make use of materials at hand, but reports that it works perfectly and that the plans and detailed description printed in MI made it a cinch to construct. The enlarger looks like a professional job, Vic, and you have every reason to be proud of your work.

***



Plans in MI helped Victor Olson build this practical photo enlarger.

This is the season when the outboard racing fans are churning up rivers and lakes with their pint-sized "water bugs" and I'll bet that George Edeal, of Harbine, Neb., is right out in front of the local crowd, for the "Pewee" boat he constructed from MI plans looks like it could work up speed on a rain drop. (Just

[*Continued on page* 12]

A Simple Recipe for Inventive Success

PROBABLY the simplest recipe for inventive success would be this: First, a practical, useful invention; second, a good, strong Patent; third, a buyer or a market. The inventor needs all three to get anywhere. Lacking any one, he is likely to get nowhere. The recipe is simple. Working it out isn't so simple. That is why inventors—and others inventively inclined—have found the two books shown here so helpful. We've gone into each part of the recipe carefully. *Exactly what is an invention?* We tell you. *What is a strong Patent?* We tell you. *How can I go about finding a buyer?* We tell you.

But there's much more. For example, just how an Application for a Patent is made; how an inventor can safeguard himself with dated sketches as he goes along; how the pertinent Patent Office records are checked to see what other inventors may have done along the same line; how some successful inventors have secured financial backing; simple ways to contact manufacturers; and many other points.

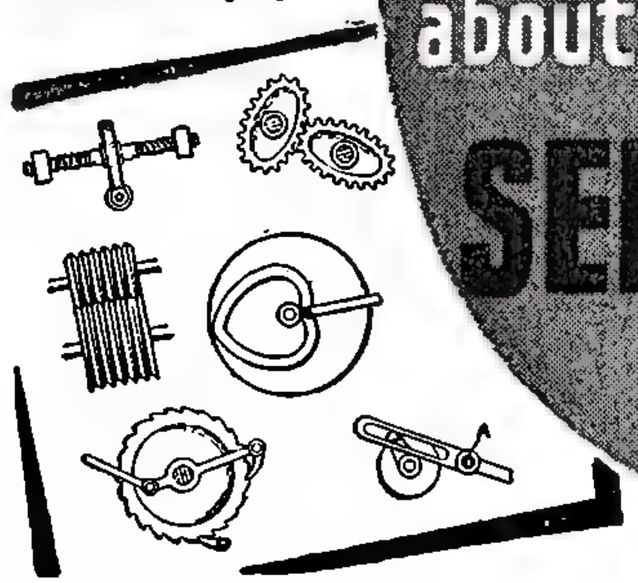
40 Years in the Business of Helping Inventors

The world needs, can use and will pay for practical, useful, inventions. Manufacturers are on the alert for new articles, or improvements that will help them increase sales. Maybe you have one. Maybe not. These books will help you in deciding that. *From that standpoint alone, they are valuable.*

For more than 40 years, it has been our business to help inventors. We answer your questions and supply complete information about Patent procedure, costs, steps to take, kind of sketch or model needed, and much more. Our staff is made up of experienced Registered Patent Attorneys, Draftsmen, Searchers. Fees are reasonable—deferred payments arranged. Whether your idea is large or small, finished or still in a rough stage, you should have the facts both about Patenting and Selling. The information which we give you—based on long experience with thousands of inventors—is yours for the asking. No need to delay. These two books of facts may save you time, trouble, money, even later disappointment. **Return the coupon—or write us a confidential letter—today.**

115 Mechanical Movements

The mechanical movements shown below are taken from 115 such movements illustrated in our book, "Patent Protection." Maybe you'll find just what you need to work out some of your own ideas. Many other interesting pictures are shown in this book. **Both books and an "Evidence of Invention" form sent to you FREE the same day we hear from you.**



PATENT and SELL your INVENTION
Suggestions on WHEN and HOW to Sell an INVENTION
PATENT PROTECTION
These TWO BOOKS tell you how to go about it – Both SENT FREE

VICTOR J. **EVANS & Co.**

REGISTERED PATENT ATTORNEYS

Main Office: 30-J, Victor Building, Washington, D. C.

Other Offices: 514-B, Empire Bldg., **Pittsburgh**
405-B, Garfield Bldg., **Los Angeles**

Send me FREE copies of your books, "Patent Protection" and "When and How to Sell an Invention." (Note: Same books supplied by either of the branch offices listed above.)

Name .....

Street and No. .....

City or Town..... State.....

Editor's Workbench Chips

[*Continued from page* 10]

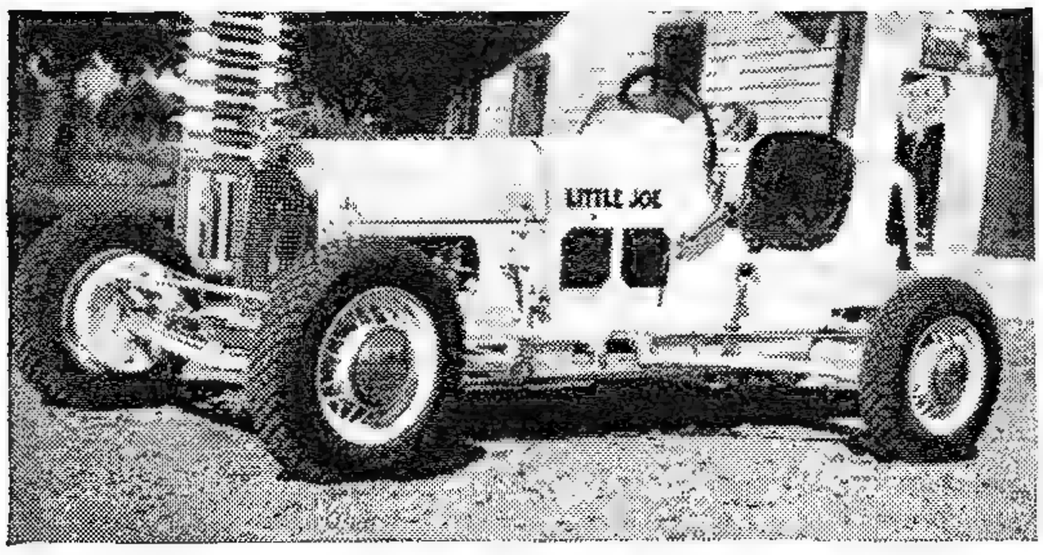
All set for a spin on the river, George Edeal casts off in his "Pewee" outboard racer, which he built from MI plans.

how much water does she draw, George?)

Building the boat was fun, according to George's letter, and I'll bet it is twice as much fun to guide her over the waves, powered by the 7½ horsepower motor with which she is equipped. I'm sending you a check for $3, George, so fill her up with gas and "let her rip." Show the local lads how a boat built from plans in the MI book—HOW TO BUILD 20 BOATS—really can go.

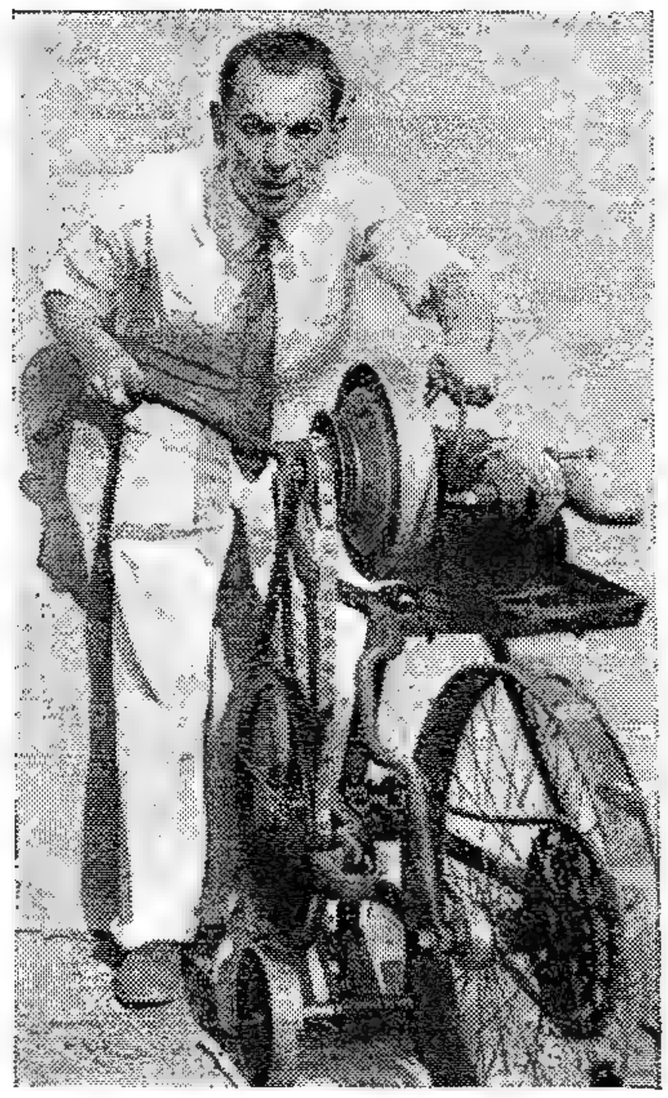
***

How do you like the midget racing car shown below? Pretty snappy, isn't it? And it can go 91 m.p.h., according to a letter from J. E. Newell, of Tuscaloosa, Ala., who built the racer to his own plans, incorporating many of the suggestions featured in articles which appeared in MI. The car has three speeds forward and one reverse, being powered with a converted motorcycle engine. Nice work, J. E., and I'm sending you a $3 award to show I mean it. Why didn't you send a photo of yourself sitting in "Little Joe," as I see you named the racer?



Powered by a converted motorcycle engine, this midget racer speeds at 91 m.p.h., according to builder J. E. Newell.

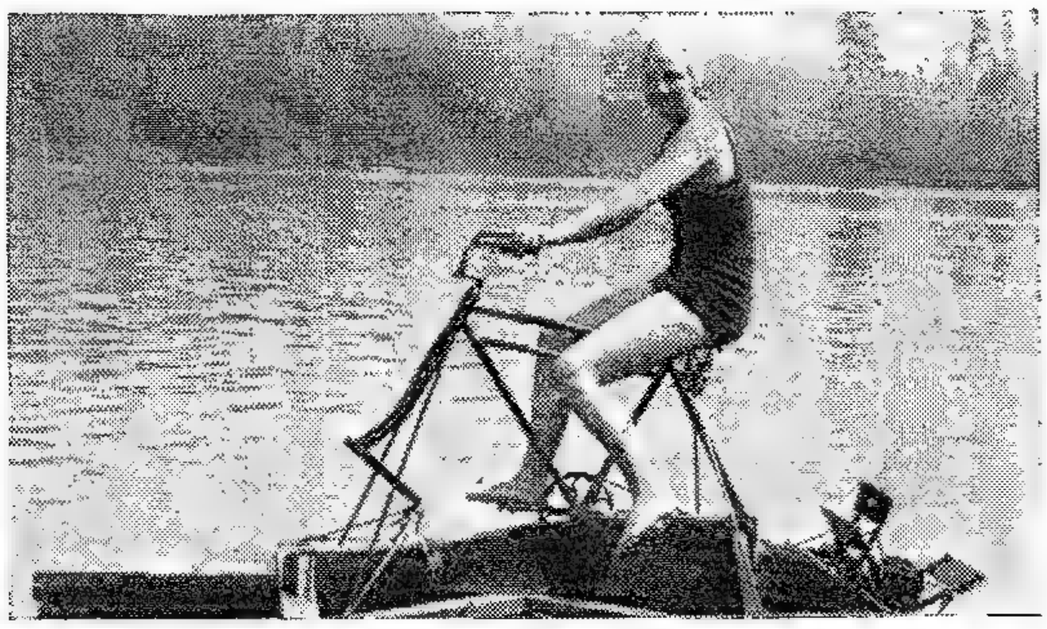
Honestly, I think MI readers can think of more different ways to use old gasoline motors than any other group in the country. Take Louis M. Goodman, of Detroit, Mich., for instance. As shown in the photo, he hooked up an old gasoline engine, part of a motorcycle frame and a leather belt and created a first class cultivator Guided by handlebars, the home-built job is easy to handle, says Goodman, and equals a horse-drawn cultivator in its capacity for work. Watch for the postman, Louis, for he'll be bringing you an MI check for $3 within a few days.



Using an old gasoline engine and salvaged bicycle parts, Louis Goodman built this handy farm cultivator.

***

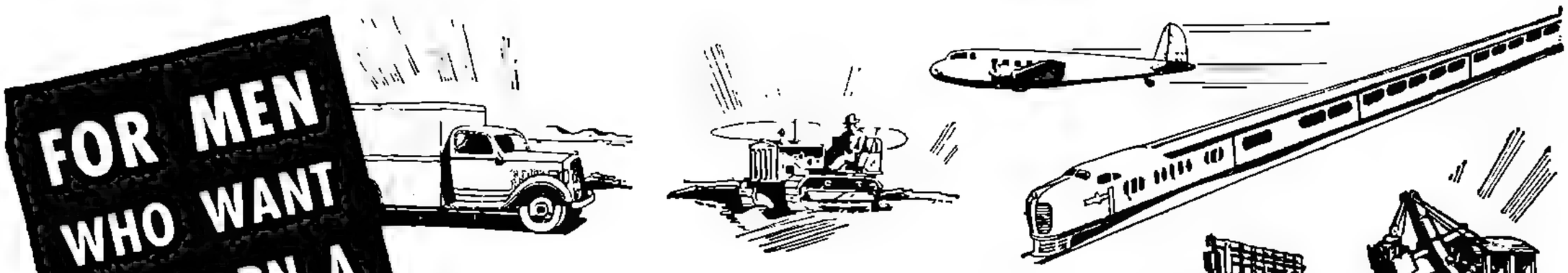
Something novel in water craft is shown in the photo sent in by A. R. MacPherson, of Tacoma, Wash., who was also awarded a $3 prize. It's a bicycle boat, the frame of the bike being mounted on two pontoons. Propulsion is accomplished by means of a small paddle wheel hooked up to the pedals with a chain while the handle bars control a small rudder. (Two of these boat-bikes and a large rubber ball make a swell combination for a game of water polo.)



Propelled by a small paddle wheel hooked up to the pedals, this pontoon bike-boat was constructed by A. R. MacPherson.

If you'd like to study the stars, you'll do well to follow the example of Allen Pabst, of Lackawanna, N. Y., who built the six-inch telescope shown in the photo on page 14. Using plans pub-

[*Continued on page* 14]



Complete DIESEL Training

HOME OF NATIONAL SCHOOLS

A million-dollar trade school occupying its own modern three-story building, exclusively devoted to training ambitious men. Latest equipment; selected, experienced staff of engineers and instructors; practical, thorough training.

PUBLIC SCHOOL SUPERINTENDENT PROFITS BY NATIONAL TRAINING

"I have attended two state universities and two state normal schools and I want you to know that I feel I have received more for my money at National than at any other school I have attended. One cannot be too high in praise of the instructors—of their determination to see that each student received complete instruction and thorough understanding of each assignment."

J. STOVER, JR.,
Sup't., Palouse Public Schools,
State of Washington.

With all Types INTERNAL COMBUSTION ENGINES ELECTRIC POWER GENERATION, etc.

YOU MEN who are sincerely ambitious to make good in the Diesel and related industries, want to know the true facts—you want to know about employment opportunities and employment requirements. For 33 years, National Schools, a recognized leader in the field of trade education, has played a vital part in helping wide-awake men to qualify for success in industry. National Schools—a million-dollar trade school—will supply you with a sincere, honest statement of facts on what you should do to get into the profitable Diesel Industry. No exaggerations—no mis-statements.

YOU NEED REAL SHOP EXPERIENCE WITH TIME-TESTED TRAINING

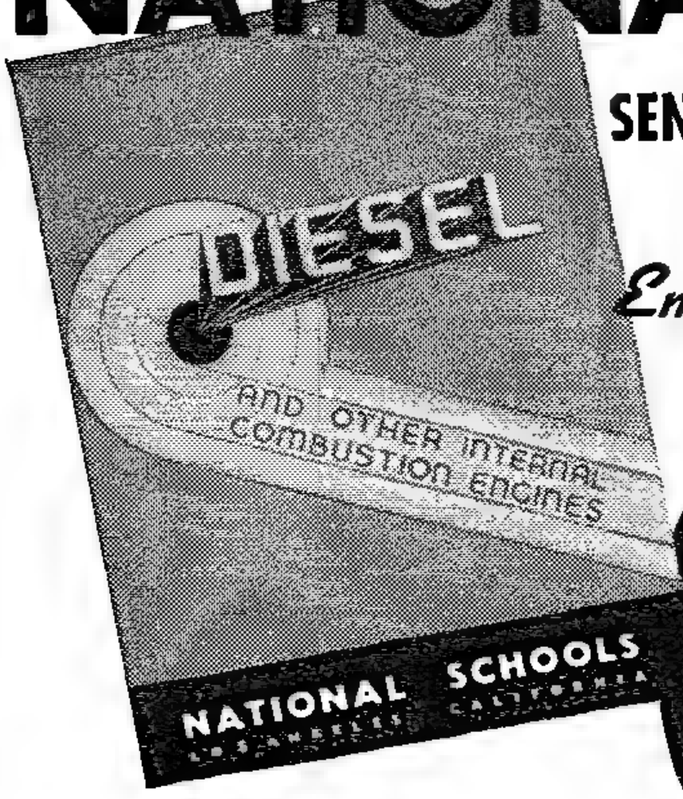
Mail the coupon below. In the literature you will be sent, you will see exactly how other men like you are preparing themselves for success in National's modern training shops. You learn on the latest, finest equipment. You do real job work. You learn by time-tested, shop-practice methods. Your training is fascinating in every detail. You are taught how to make good, and helped to make good after you graduate. All of this and much more is clearly pictured for you in the Free Book of Facts we will send to you.

TRANSPORTATION ALLOWED TO LOS ANGELES

National Students are allowed coach railroad fare from any point in U. S. (Canadian students from nearest point of entry.) Student social life includes inspection trips, excursions, athletic activities, etc. Special doctor service. Personality coaching. Many students are helped with spare-time jobs to earn room and board while learning. (Canadians excepted.) Graduate employment cooperation.

National Training is so thorough and all-inclusive, that no ambitious man can afford to consider Diesel Training without first knowing all of the facts regarding the many advantages available to him as a National Student. INVESTIGATE.

NATIONAL SCHOOLS *Los Angeles*



SEND FOR YOUR COPY TODAY

—Real Facts on Diesel Employment Requirements

Free NEW BOOK OF TRAINING FACTS

Request for Free Book

NATIONAL SCHOOLS
(established 1905) Dept. MMA-8
4000 S. Figueroa St., Los Angeles

Please send me, without obligation, your FREE BOOK and information regarding Diesel Employment Opportunities and Requirements.

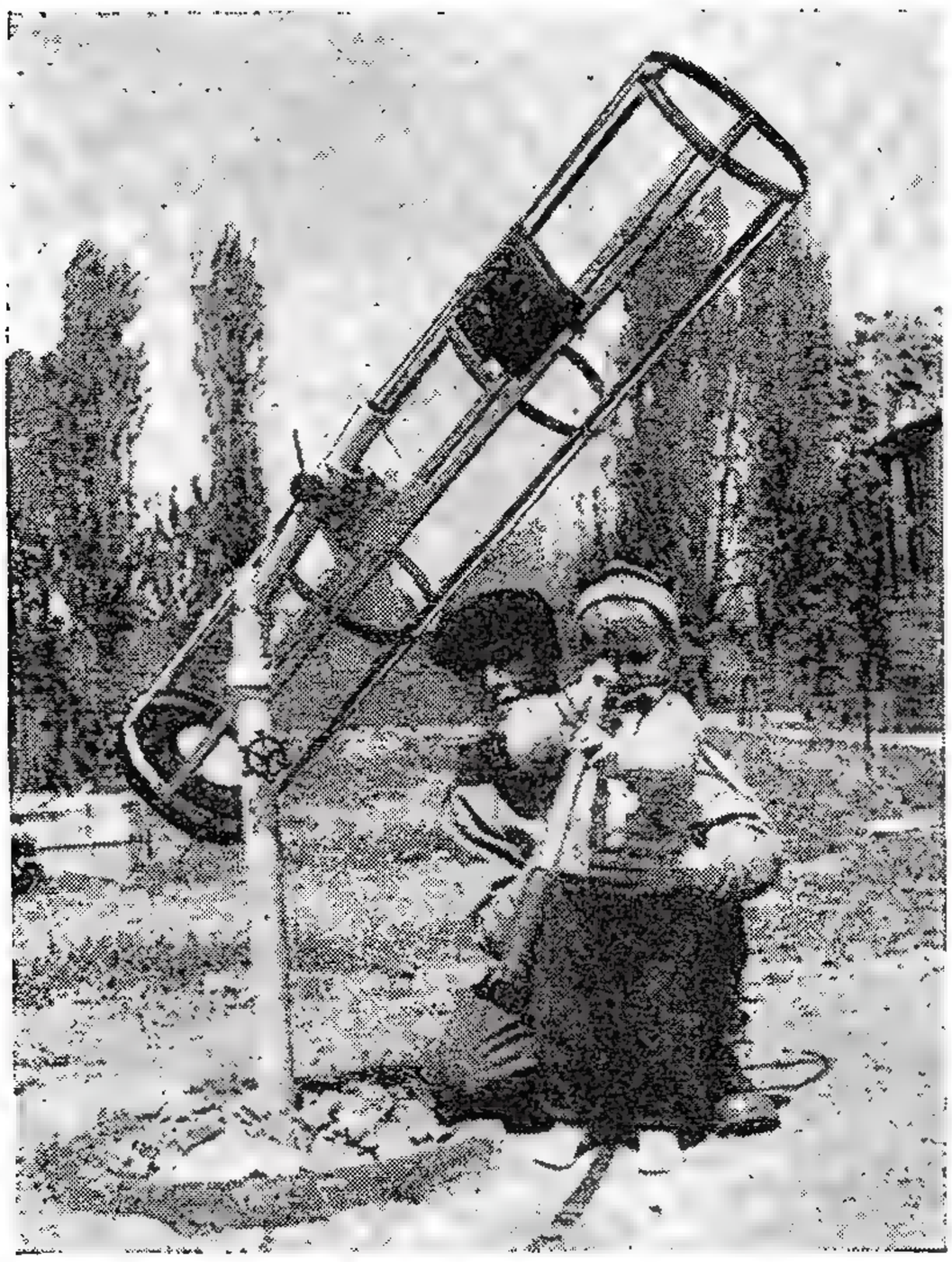
NAME_____ **AGE**____

ADDRESS_____

CITY_____ **STATE**_____

Editor's Workbench Chips

[*Continued from page* 12]

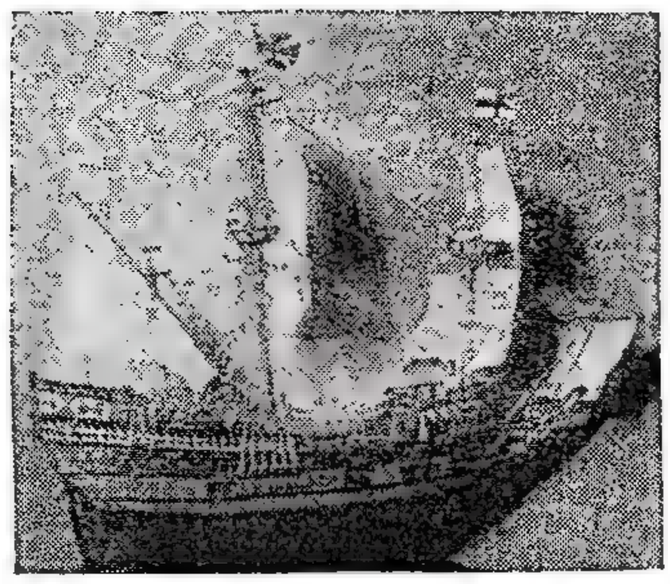


A star-filled sky holds thrills for Allen Pabst, who built this six-inch telescope from MI plans at a cost of $6.23. Looks like Junior is showing interest in telescopes, too.

lished by MI, Allen built his telescope at a cost of only $6.23 and reports that the results equal those expected of a telescope costing many times as much. Now that you have been awarded a $3 prize, Allen, your telescope costs only $3.23. I may get up your way soon, Allen, and if I do I aim to drop in for a peep through the 'scope. Okay?

Not only did Roy S. MacNeill, of Shelley, B. C., Canada, send in a photo of a model "dinky" engine he constructed, but he put himself right in the photo as the "engineer," as well. Pretty clever, Roy, and well worth the $3 prize I've sent you.

Roy's "dinky" engine features running gear, valve gear and brakes that actually work. The entire engine is 11 inches long and the cab fittings are complete, right down to levers and gauges. How many of you model railroad fans recognize the engine prototype after which Roy's "dinky" is modeled?



Building this *Mayflower* model taught S. C. Middlebrook much about ships' details and aroused his desire to construct a real sailboat from MI plans.

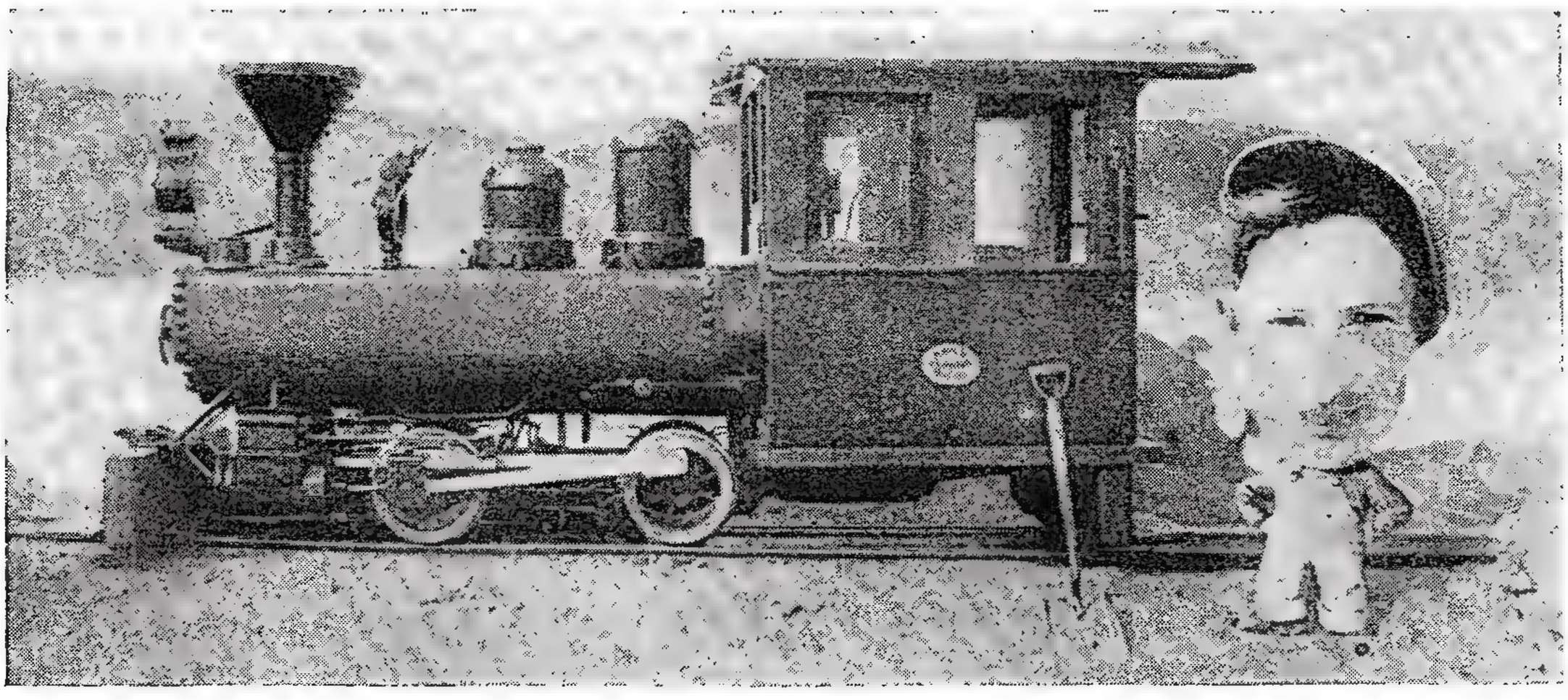
***

Modeling boats has always been a popular hobby and looking at the *Mayflower* model shown in the photo above, I can readily understand the appeal of the subject. S. C. Middlebrook, of New Richmond, Wis., built the model from MI plans as a diversion from office routine and says it has increased his knowledge of ships considerably. He is now planning to build a large sailboat from plans in the MI boat book, so I know the $3 award I sent him will come in handy.

***

Under the guidance of the Soaring Society of

[*Continued on page* 16]



This detailed scale model "dinky" engine was built by Roy MacNeill and the "engineer" is none other than Roy himself.

You're LICKED *unless you* LEARN

• Truth is strong medicine. The truth about millions of men in American industry is this—*they don't KNOW enough to succeed!* They lack the knowledge and training that only *study* can give them.

The names of I. C. S. students are the names of those men who refuse to submit to circumstances that deprive them of high school or college educations. They study at home, in their spare time. They *refuse* to be licked by lack of training!

Are you going to admit defeat? Or, are you going to mail the attached coupon *today*—for a happier *tomorrow!*

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 2323-Q, SCRANTON, PENNA.

★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the subject *before* which I have marked X: ★

TECHNICAL AND INDUSTRIAL COURSES

- ☐ Architect
- ☐ Architectural Draftsman
- ☐ Building Estimating
- ☐ Contractor and Builder
- ☐ Structural Draftsman
- ☐ Structural Engineer
- ☐ Management of Inventions
- ☐ Electrical Engineer
- ☐ Electric Lighting
- ☐ Welding, Electric and Gas
- ☐ Reading Shop Blueprints
- ☐ Heat Treatment of Metals
- ☐ Sheet Metal Worker
- ☐ Boilermaker
- ☐ Telegraph Engineer
- ☐ Telephone Work ☐ Radio
- ☐ Mechanical Engineering
- ☐ Mechanical Draftsman
- ☐ Machinist ☐ Toolmaker
- ☐ Patternmaker
- ☐ Diesel Engines
- ☐ Aviation Engines
- ☐ Auto Technician
- ☐ Auto Electrical Technician
- ☐ Commercial Refrigeration
- ☐ Plumbing ☐ Steam Fitting
- ☐ Heating ☐ Ventilation
- ☐ Air Conditioning and Cooling
- ☐ Steam Engineer
- ☐ Steam Electric Engineer
- ☐ Marine Engineer
- ☐ R. R. Locomotives
- ☐ R. R. Section Foreman
- ☐ Air Brakes ☐ R. R. Signalmen
- ☐ Highway Engineering
- ☐ Civil Engineering
- ☐ Surveying and Mapping
- ☐ Bridge Engineer
- ☐ Bridge and Building Foreman
- ☐ Chemistry ☐ Pharmacy
- ☐ Coal Mining
- ☐ Mine Foreman ☐ Fire Bosses
- ☐ Navigation
- ☐ Cotton Manufacturing
- ☐ Woolen Manufacturing
- ☐ Agriculture
- ☐ Fruit Growing
- ☐ Poultry Farming

BUSINESS TRAINING COURSES

- ☐ Business Management
- ☐ Industrial Management
- ☐ Traffic Management
- ☐ Accountancy
- ☐ Cost Accountant
- ☐ C. P. Accountant
- ☐ Bookkeeping
- ☐ Secretarial Work
- ☐ Spanish
- ☐ French
- ☐ Salesmanship
- ☐ Advertising
- ☐ Service Station Salesmanship
- ☐ First Year College Subjects
- ☐ Business Correspondence
- ☐ Stenography and Typing
- ☐ Civil Service ☐ Mail Carrier
- ☐ Railway Mail Clerk
- ☐ Grade School Subjects
- ☐ High School Subjects
- ☐ College Preparatory
- ☐ Illustrating
- ☐ Cartooning
- ☐ Lettering Show Cards ☐ Signs

DOMESTIC SCIENCE COURSES

- ☐ Home Dressmaking
- ☐ Professional Dressmaking and Designing
- ☐ Advanced Dressmaking
- ☐ Foods and Cookery
- ☐ Tea Room and Cafeteria Management, Catering

Name.....*Age*.....*Address*.....

City.....*State*.....*Present Position*.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

Be Your Own MUSIC Teacher

LEARN AT HOME

by wonderful improved method. Simple as A. B. C.—a child can learn it. Your lessons consist of real selections instead of tiresome exercises. When you finish one of these delightfully easy lessons you've added a new "piece" to your list. You read real notes, too—no "numbers" or trick music. Method is so thorough that many of our 700,000 students are band and orchestra LEADERS.

PLAY BY NOTE

Piano — Guitar
Violin — Saxophone
Organ — Mandolin
Cornet — Ukulele
Trombone — Harp
Piccolo — Clarinet
Flute — 'Cello
Hawaiian Steel Guitar, Trumpet, Piano Accordion, Plain Accordion, Voice and Speech Culture, Harmony and Composition, Drum and Traps, Banjo (Plectrum, 5-string or Tenor)

Be Popular

Everything is in print and pictures. First you are *told* what to do. Then a picture *shows* you how to do it. Then you do it yourself and *hear* it. In a few short months you become an excellent musician—the life of every party!

Free Book and DemonstrationLesson

You may quickly become a fine player through the U. S. School home study method. Write today for Free Book and Free Demonstration Lesson which explain all. Please mention your favorite instrument and write your name and address plainly. Instruments supplied when needed, cash or credit.

U. S. SCHOOL OF MUSIC
2628 Brunswick Building, New York City

NELSON'S LIQUID SPRAY

THE HANDIEST SPRAY EVER MANUFACTURED AT THIS PRICE

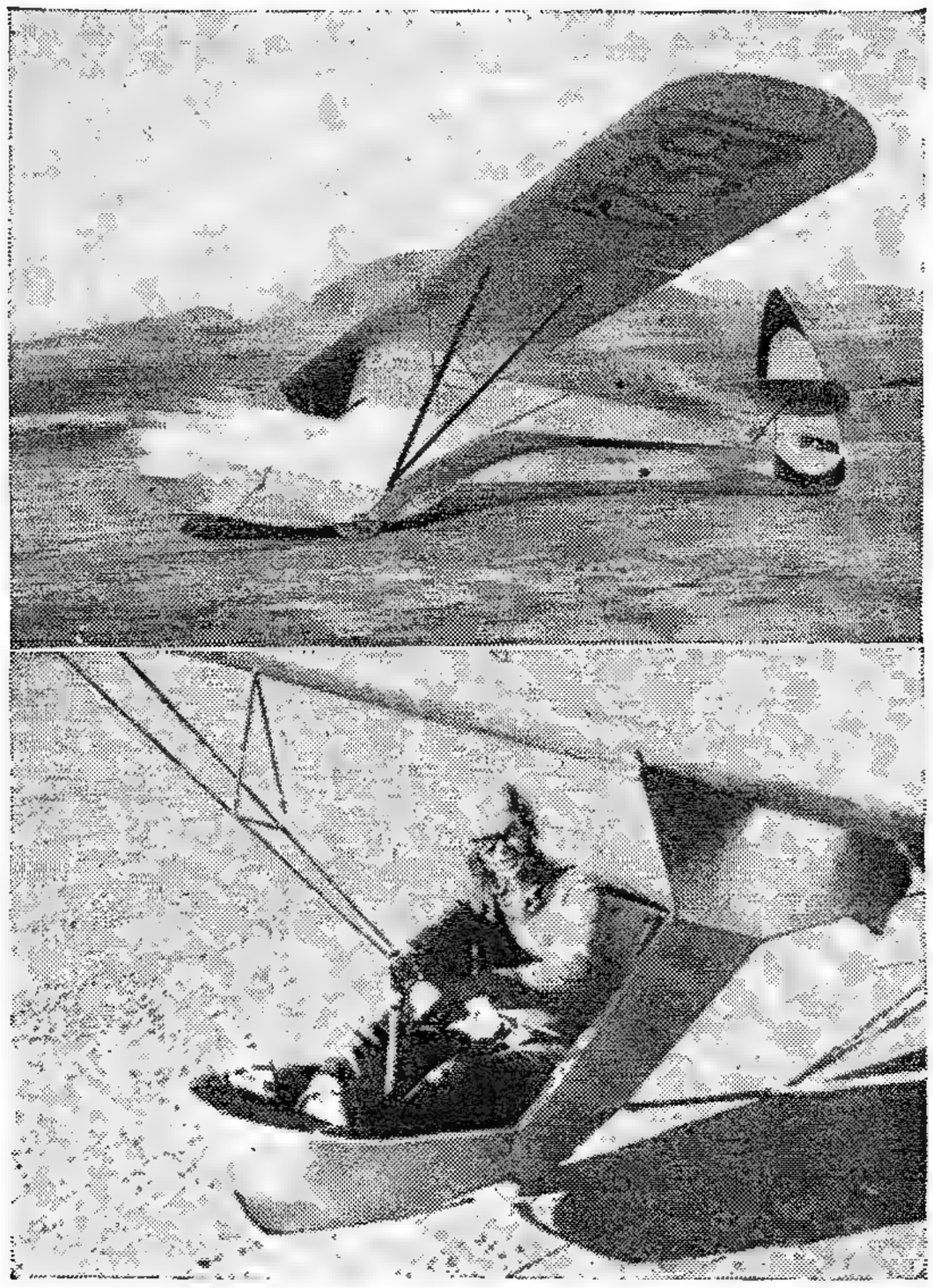
$5.00 F. O. B. DANVILLE

This handy liquid spray, weighing less than ten pounds, is ideal for painting walls and furniture, eliminating all the worry of brush marks and streaks. For fumigation and insecticide jobs, it combines all the requirements for efficient, economical and thorough work. Constructed of strong durable material and technically assembled, which provides service over a long period of time. It consists of a foot-power pump which forces air into a reservoir, from which it passes thru regulating valves which maintain an even pressure thru the spray container and into the gun. The operator simply pedals the pump with one foot, holding the spray gun in one hand. Costs nothing to operate.

WASH CO., INC.
DANVILLE - - - - ILLINOIS

Editor's Workbench Chips

[*Continued from page 14*]



Clair Roberts, of the Studio Glider Club, sent in this photo of a glider (top) built for the club by William Briegleb. The close-up shows the pilot's cockpit with the cowling removed.

America there has been a rebirth of gliding and soaring activity throughout the United States and, as usual, MI readers are right "on the spot." To prove my claim, I'm running a photo sent in by Clair Roberts, of Glendale, Calif., showing the glider used by the Studio Glider Club, of which he is a member. Clair says the glider was built by William Briegleb, who acts as the club's instructor, and is of conventional wooden wing and metal fuselage construction. The glider has a wingspan of 32 feet, 3 inches, and an overall length of 18 feet.

Further interesting data on the glider, as supplied by Clair, reveals that the glider has a gliding angle of 16 to 1, a sinking speed of 2.8 feet per minute, lands at 30 m.p.h., and takes off at 33 m.p.h., with a 160-pound pilot aboard. The weight of the glider empty is 170 pounds. Like other glider enthusiasts, the members of the Studio Glider Club are anxious to spread interest in the subject and inquiries from MI readers are invited. Send your inquiry to the MI office and I will see that it is placed in Clair's hands.

Thanks for the "dope" on the glider, Clair. I'm sending you a $3 award so treat the club members to a soda "pop" toast for Happy Landings.

The Editor.

Enjoy a Real Job in Industry

Steady Work

As nearly all manufacturing and building starts on the drafting table, the draftsman is one of the first to be hired, last to be laid off. His blueprints, his specifications, give the final word in what the workmen are to do.

Good Pay

The draftsman has been called the Junior Engineer, which accurately describes his work, position and pay. He combines knowledge of principles, mechanism and construction details with ability to draw plans and indicate methods. Usually his salary is considerably above the wages of the mechanic and, of course, less than that of the engineer.

Chance for Promotion

Helping design new buildings, machines or construction methods, the draftsman knows what his firm is planning or considering. It may be the superintendent—engineer—even the prospective buyer with whom he consults. These contacts, plus his experience, place him in an excellent position for promotion when next there is a good opening.

Young at 40

Athletes, farmers, factory and shop workers — all who rely on muscle often are old at 40. Office workers — executives, teachers, professional men, *draftsmen*—just approach their prime at 40 to 50. Training increases your value AT ONCE and *continues* to help boost your earning power as you mature.

Become a Draftsman

Don't Be Just Average

What happens to the average man? Not having thorough training for a worth-while job, he goes along year after year, wishing he had a good job, but wishing was never a substitute for training. $40 a week is about his top, usually never that high. Grows old on the job, starts down at 40, finds himself slipping in speed and salary.

Security for Yourself and Family

Even if you are now only 18, 25 or 30, you should *look ahead* —begin training TODAY for the job you want at 50. Training helps you to be independent—self-supporting. It helps you to enjoy associations denied to untrained men. Training helps you to offer your family advantages far in excess of what you could give them as an untrained man. Investigate NOW.

American School, Dept. DDC 28, Drexel at 58th, Chicago

Learn DIESEL IN THE GREAT NORTHWEST

"THE LAND OF OPPORTUNITY"

WHERE YOU SHOULD LEARN DIESEL

The Pacific Northwest, home of the Adcox School, is alive with Diesel activity. Every branch of the Diesel industry is represented here, including trucks, tractors, Diesel shovels, Diesel donkeys, Diesel motors in mines, Diesel motors in power plants, large and small boats. The use of Diesel Power in the Northwest is probably more diversified than in any other Diesel center in the World. The activity of the Diesel industry in the Northwest is assurance of a real opportunity for trained Diesel men.

ENJOY LIVING

Study in the matchless climate of the beautiful State of Oregon. Enjoy numerous outdoor recreations such as fishing, hunting, sightseeing, mountain climbing, swimming, and other thrilling, healthful recreations. Truly there is no finer place in all America to study, work, play and live a life of happiness and success than in Portland, Oregon, the center of the great Pacific Northwest.

THE SCHOOL TO ATTEND

The Adcox School, located in Portland, has been in business for 30 years, and is one of the finest practical trade schools in America—students enrolled from every section of the United States and many foreign countries—hundreds of successful graduates.

NEW 48 PAGE CATALOG GIVES FACTS

The new big Adcox catalog tells what you should know about Diesel Schools and Diesel Jobs. No misrepresentation. You will enjoy reading this book—it's from friendly people interested in your success. Send at once for your free copy. Use coupon or ask for book No. 31.

DIESEL BOOK FREE

Mr. L. L. Adcox, President
L. L. Adcox Trade School
237 N. E. Broadway, Portland, Oregon

I'll be glad to read your book No. 31 that will put me straight on Diesel Schools and Diesel Jobs.

Name ----------

Address ----------

Town ---------- State ----------

DO YOU LIKE

RADIO

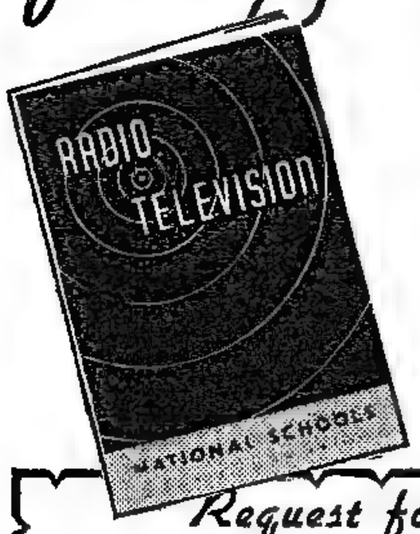
DOES THE FUTURE OF

TELEVISION

INTEREST YOU?

Send for your free copy

You men anxious to make good in radio and related industries want the true facts,—you want to know about employment opportunities and requirements. National Schools,—a million-dollar trade school,—will supply you with a sincerely honest statement of facts on what you should do to get into the profitable radio industry. No exaggerations,—no mis-statements. Mail coupon today. ¶Send for your free copy. Real facts on radio employment requirements. ¶You need real experience. National offers complete training with modern equipment.



NATIONAL SCHOOLS
Los Angeles

Request for **FREE BOOK of DETAILS**

NATIONAL SCHOOLS,
Dept. MMR-8, **4000 S. Figueroa St., Los Angeles, Calif.**

NAME_____ **Age**_____

ADDRESS _____

CITY_____ **STATE**_____

NEW

BENJAMIN AIR PISTOLS

$7.50

Powerful—Accurate—Economical—Practical—Adjustable Shooting Force—Amazing Maximum Velocity—cal. 177 or 22 and BB—For Target and Small Game—**the only Genuine Compressed Air Pistol for Shooting BB on the market**—Single Shot with Bolt Action—Hammer Fire—Hair Trigger—Safety. Price $7.50. Holster $2.00. Also 177 and 22 Single Shot Air Rifles $7.50—Single Shot BB Air Rifle $6.00—25 Shot BB Repeater Air Rifle $7.50—at Dealer or Direct—No license required—Safe for indoor use. **FULL DETAILS—TARGETS—FREE—WRITE TODAY.**
Benjamin Air Rifle Co., 831 Marion St. St. Louis, Mo.

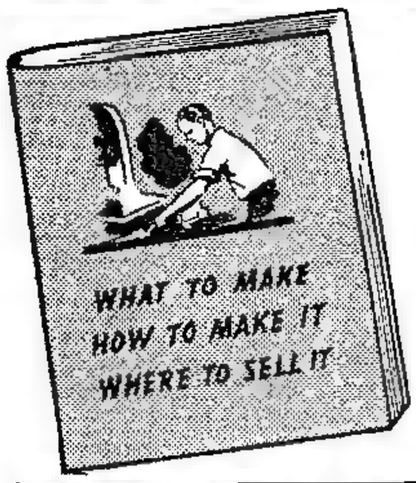
AUTO COMPASS

The latest model aviation type auto compass. Neat. Compact. Length 2½ inches. Attractively finished. Fluid stabilized dial. Genuine sapphire jewel. Built-in compensators, universal mounting. Tells accurate direction of every turn in the road. Only $2.50 postpaid. Returnable if not pleased. Descriptive folder on request.

Dealers, Write For Particulars

LOCKWOOD COMPASS COMPANY
210-C West 8th St., Kansas City, Mo.

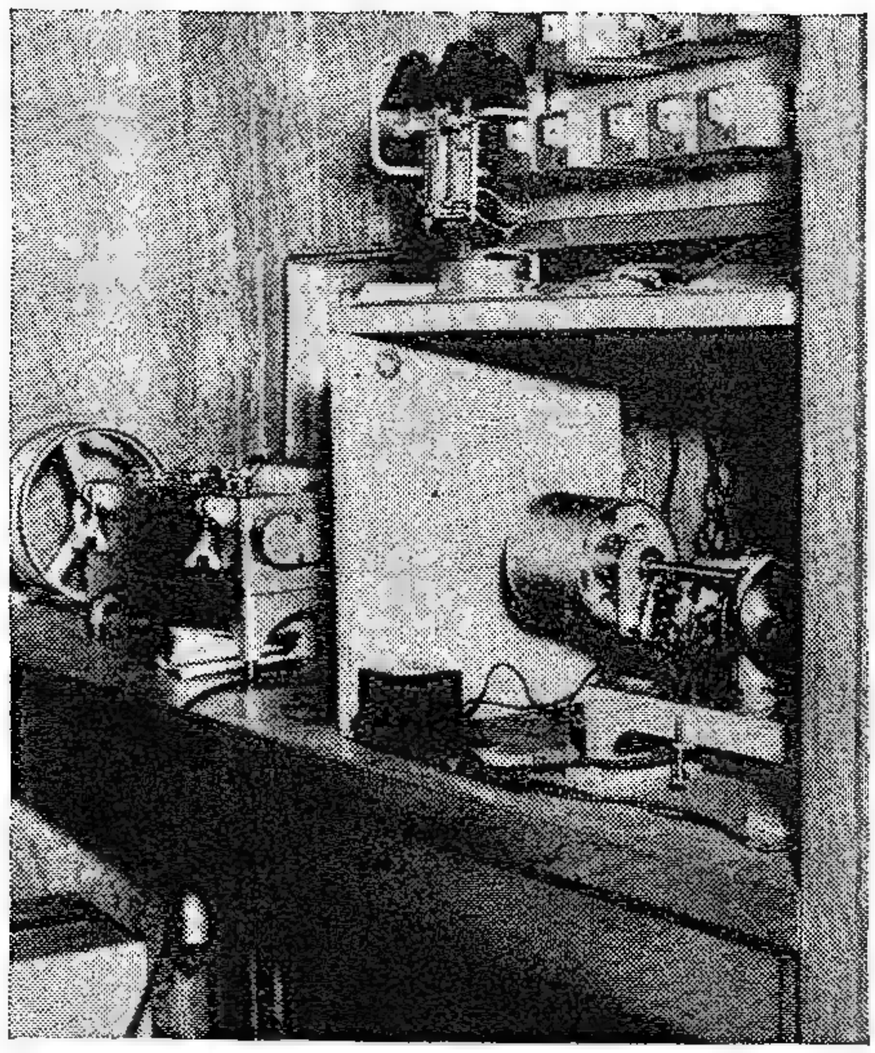
Earn Spare-Time Money THIS NEW PLEASANT WAY!



Learn how you can build up a profitable spare or full-time business in your own home. This new book "How to Make Money in Woodworking" is crammed with practical tested ideas, plans, and suggestions. Tells you exactly what to make, how to make it and how to sell it. Describes plans that have worked for others. Woodworking, the new way is light, pleasant, and profitable. Send only 10c and complete book will be mailed postpaid. Satisfaction guaranteed or money refunded. Write to Dept. M838.

Delta Mfg Co. 600 E. VIENNA AVE. MILWAUKEE, WIS.

River Gauge Automatically Telephones Flood News



Floods of the future will telephone news of their progress to observers who may be miles away, by means of a new automatic device which has been under test at the U. S. Weather Bureau in Washington, D. C.

The operation is very simple. The observer picks up his telephone, dials a certain number. The answer is the sharp sound of a gong, followed immediately by a buzz. After an interval of silence comes a second buzz. The observer times the interval with a stopwatch. He divides the number of seconds by 30. The answer is the river's height in feet above a fixed zero mark.

Next improvement will be the addition of a device which will preface the sound signal with the explanatory spoken words, "This is the river gauge station of the Weather Bureau." This will warn switchboard operators not to disconnect the call merely because they hear no conversation going on.

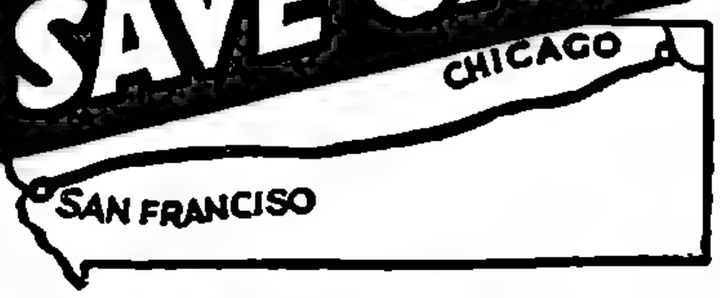
The new automatic telephoning mechanism will be housed in the same tall, narrow concrete structures that contain the self-recording river gauges recently developed by the Weather Bureau. The telephone attachment will obviate the frequent visits by observers now necessary, and will also make possible the reading of the gauges when they are isolated by high water.

A shortage of mercury was threatened last year because of European conditions, but more than enough of this metal was produced to supply the needs of leading industrial nations.

Eleven of the chemical elements make up 99 and one-half per cent of the earth's crust.

Read the Sworn Statements of Motorists

Who Else Wants To SAVE GAS?



With

The undersigned being duly sworn says:
"5 MILES MORE PER GALLON"
F. L. Van Ness, Mich.

The undersigned being duly sworn says:
"8 MILES TO GALLON MORE"
G. R. Marman, Pa.

Write for More Statements

The undersigned being duly sworn says:
"4 TO 6 MORE MILES TO GALLON"
D. C. Brame, Ont.

JACK SMEAD
Service Manager Says:
"$19.38 SAVINGS IN GASOLINE"
ON MOTOR TRIP SAN FRANCISCO to CHICAGO

AMAZING Improved GAS ECONOMIZER

When you get MORE MILES per gallon of gas you get money saving results, YOU SAVE UP-KEEP COST. Hundreds of letters in our files from auto owners of every make tell us our wonderful gas economizer has saved money for them and reduced auto running expense by getting MORE MILES PER GALLON OF GASOLINE. Note a few in this ad and write us for complete revealing details of this world famous invention and our trial plan whereby YOU can try one on your own car and if you don't think it's wonderful, the trial costs you nothing.

Anyone can attach to any auto—as inexpensive as a good wrench—absolutely automatic and self-regulating.

New Improved Gas Economizer

SENT ON 30 DAYS TRIAL

Costs Nothing if it Does Not Save Gas

Yes, you may try this new improved gas economizer on your own car under our liberal 30-day trial offer—check your gas mileage BEFORE you install it, CHECK it again AFTER you install it—then, you be the judge, and if it does not save gas, save money for you, and you are willing to return it under our liberal guarantee within the 30-day trial period, it costs you nothing—but, that's not all, we will even pay you a bonus for testing it if not delighted—so, you can't lose. Without obligation, send name and address on coupon below—or paste on 1c postcard and mail NOW.

AGENTS SALESMEN, BIG MONEY MAKING OPPORTUNITY

Startling demonstrator. Convinces motorists—makes sales quick, easy. T. M. Wiley says, "Cleared $39 in 3 hours—on previous Saturday I cleared $18." Get unusual money making plan and offer of NO-COST SAMPLE to salesmen for a little easy work, spare or full time. Write quick—be first in your locality—check coupon below, now.

J. A. STRANSKY MFG. CO.,
K-600, Pukwana, So. Dak.

Mail Coupon

J. A. STRANSKY MFG. CO., K-600, Pukwana, So. Dak.

Without cost or obligation, send your TRIAL OFFER and GUARANTEED BONUS OFFER.

Name .....

Address .....

City ..... State .....

☐ CHECK HERE if interested in NO-COST SAMPLE and money making plan.

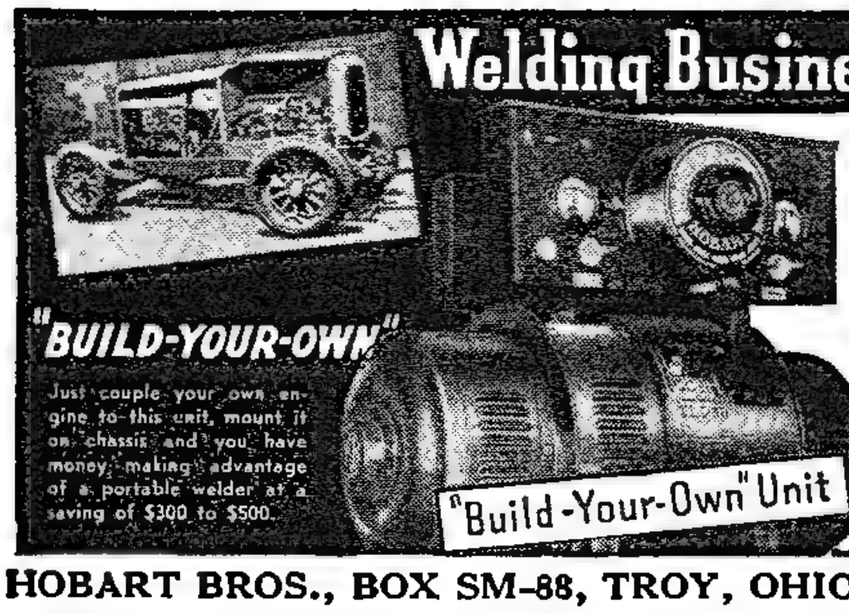
MI BLUEPRINTS make the job easier

Simply say, "Please send me the MI Blueprint Booklet," and write your name and address clearly.

FAWCETT PUBLICATIONS, Inc.
FAWCETT BUILDING
GREENWICH, CONN.

Large blueprints of many of the construction projects described in MECHANIX ILLUSTRATED are available at low prices. Because they greatly simplify work in the shop they are popular with MI readers the world over. A booklet describing all of these plans in detail is free for the asking; write today for your copy.

Welding Business Earns $150 to $300 for You Each Month


"BUILD-YOUR-OWN"
Just couple your own engine to this unit, mount it on chassis and you have money making advantage of a portable welder at a saving of $300 to $500.
"Build-Your-Own" Unit

30 DAY'S TRIAL AT HOBART'S RISK AND EASY "PAYS FOR ITSELF" TERMS

New low prices make this profitable welding service available to everyone. Opens doors to big pay jobs that carry real profit. Hobart Welders are easier to operate, faster, guaranteed to bring you quality welding business . . . extra profits will pay for welder without expense to you.

NO INVESTMENT TERMS—PROFITS PAY FOR IT

Extra earnings and savings possible with Hobart Welders make it easy to own without expense. You can even rent a new Hobart and later purchase it without loss. Coupon brings details.

HOBART BROS., BOX SM-88, TROY, OHIO

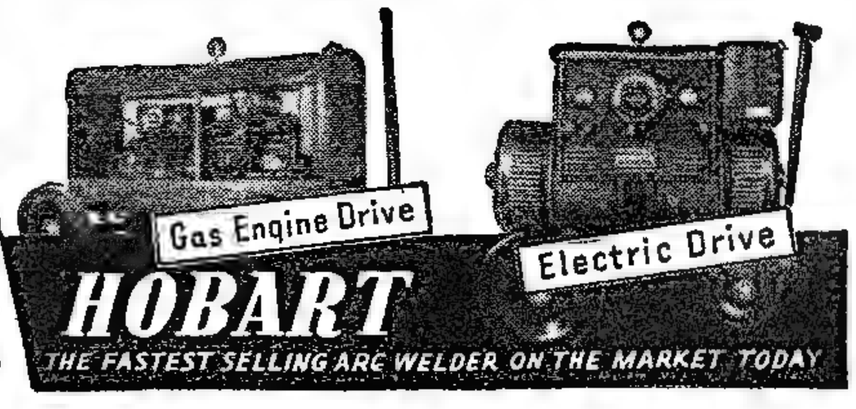
Gentlemen: Send me information on ( ) Build Your Own Welder ( ) Electric Drive Welder ( ) 30 Days Trial, Easy Terms ( ) Rental Plan. Also send me free books I've checked.

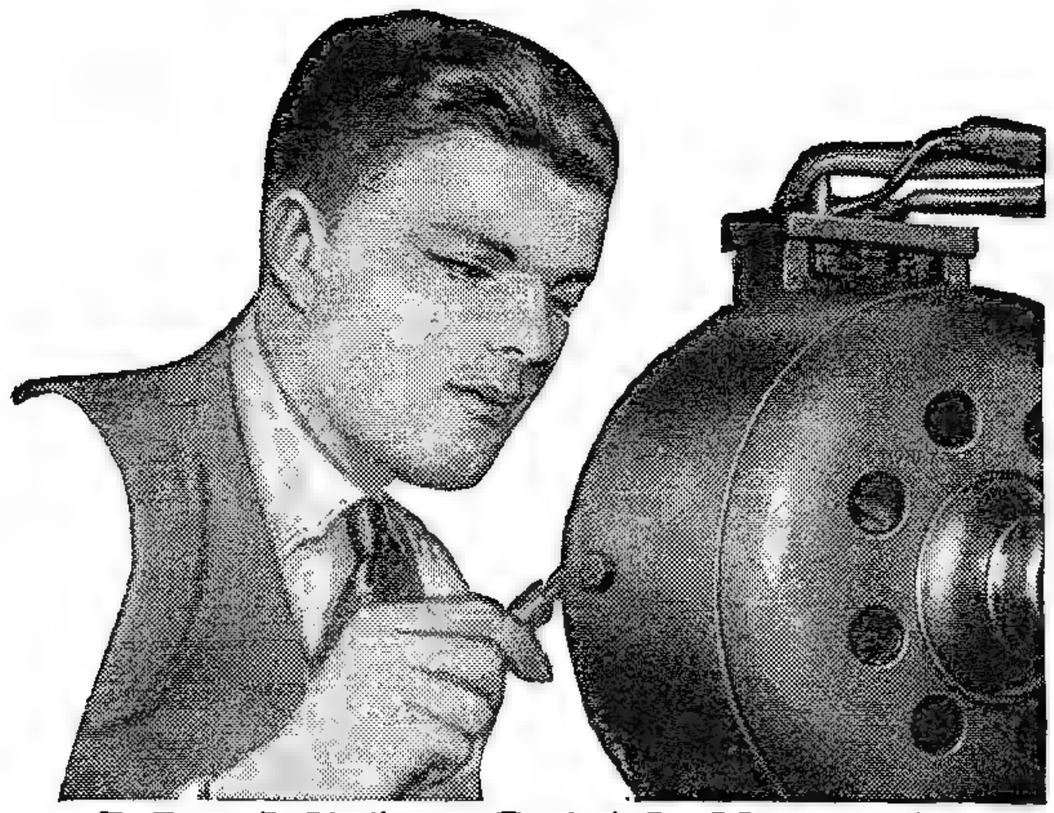
Name .....

Address .....

Free! VALUABLE BOOKLETS ON WELDING. CHECK YOURS AND MAIL THE COUPON TODAY.

- ☐ *How to "Build-Your-Own"*
- ☐ *New Profits in Arc Welding*
- ☐ *New Arc Welding Catalog*





AMAZINGLY EASY WAY TO GET INTO ELECTRICITY

12 Weeks' Practical Training in the big Chicago Coyne Shops

Let us prepare you for your start in a good paying field. **Let us teach you how to prepare for positions that lead to good salaries in Electricity**—NOT by correspondence, but by an amazing way we teach **right here in the great Coyne Shops. You get a practical training in 90 days.** Electricity offers many opportunities to the trained man. Prepare today to take your place in the great field of Electricity. **Mail coupon today.**

LEARN BY DOING—IN 90 DAYS BY ACTUAL WORK—IN COYNE SHOPS

I don't care if you don't know an armature from an air brake—I don't expect you to! Coyne training is practical "**learn-by-doing**" training. Don't let lack of money hold you back from getting all details of my amazing plan.

MANY EARN WHILE LEARNING

If you need part time work to help pay your expenses, we may be able to help you as we have hundreds of others. **When you graduate we'll give you lifetime employment service.** And, in 12 brief weeks, **in the great shops of Coyne,** we train you as you never dreamed you could be trained . . . on one of the greatest outlays of electrical apparatus ever assembled . . . real dynamos, engines, power plants, autos, switchboards, housewiring, armature winding and many other branches of Electricity.

ELECTRIC REFRIGERATION AIR CONDITIONING

Right now we are including additional instruction in Electric Refrigeration and Air Conditioning without extra cost so that your training will be more **complete** and you can get into this marvelous, rapidly expanding field.

GET THE FACTS Coyne is your great chance to get into Electricity. This school is 39 years old—Coyne training is tested. You can find out everything absolutely free. Simply mail the coupon and let us send you the big, free Coyne book with photographs . . . facts . . . opportunities. Tells you how many earn expenses while training and how we assist our graduates in the field. No obligation to you. So act at once. Just mail coupon.

BIG FREE BOOK! Send for my big book containing photographs and telling the complete story—absolutely FREE.

H. C. Lewis

COYNE ELECTRICAL SCHOOL

500 S. PAULINA ST., Dept. C8-53, CHICAGO, ILL.

H. C. LEWIS, Pres., COYNE ELECTRICAL SCHOOL
Dept. C8-53, 500 S. Paulina St., Chicago, Ill.

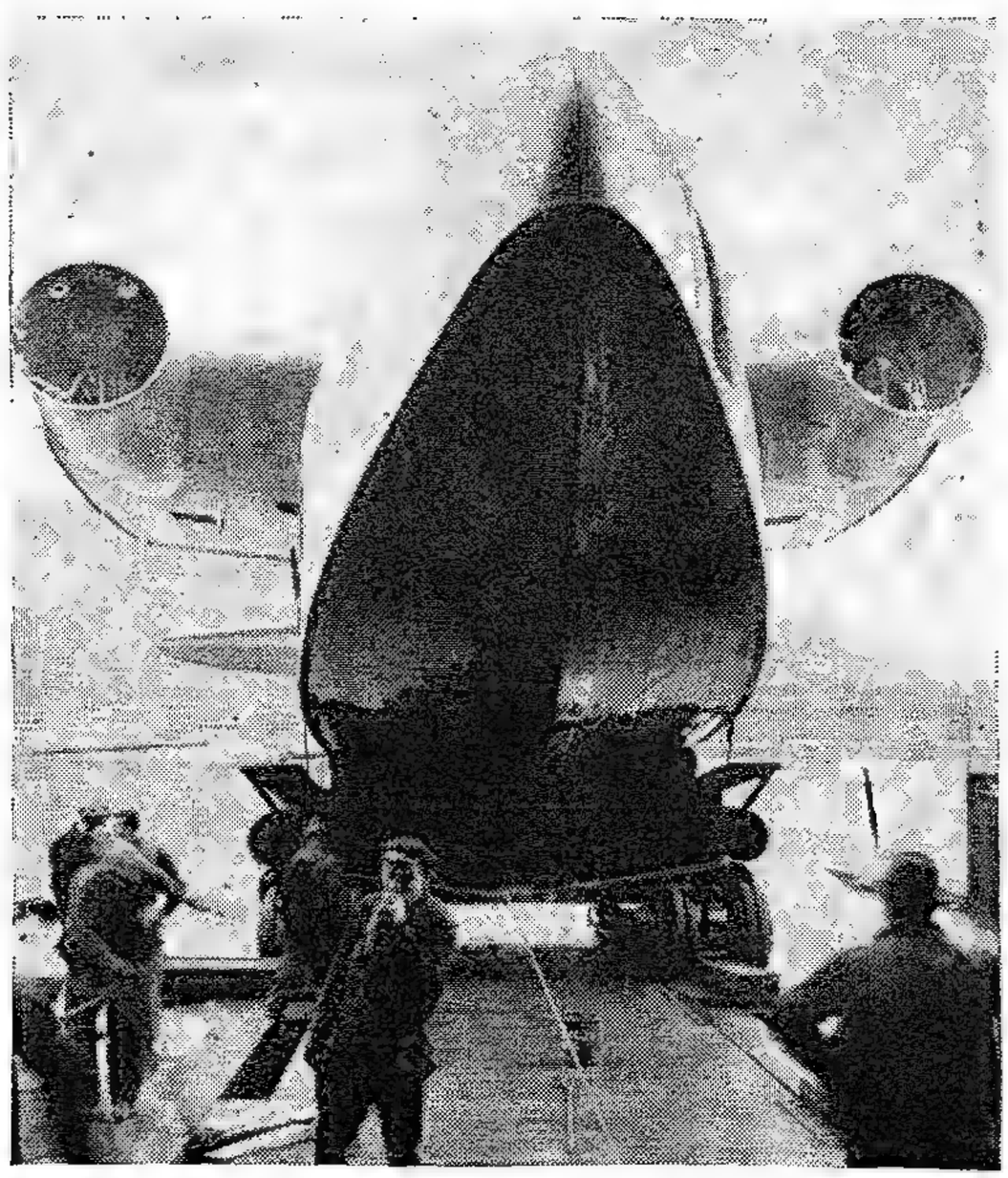
Dear Mr. Lewis: Without obligation send me your big, free catalog with facts about Coyne Training and details of your "Plans" to help me.

Name..... *Age*.....

Address.....

City..... *State*.....

Giant "Clipper" Plane Needs Special Beaching Gear



Developed specially for use in launching and docking the new Boeing 74-passenger "Clipper" plane, which is now under construction, an all-welded steel beaching gear weighs 15 tons and has eight huge wheels for use on ramps. Twenty-two feet long, the beaching device is constructed with members in the form of flotation tanks with airlocks, and additional air tanks to assure an excess buoyancy of about 2,000 pounds when supporting the plane's 82,000-pound weight in the water. The photo above shows the hull and wing center-section of the new transport plane being pulled up a ramp on the beaching gear.

College Students Now Favor Chemical Engineering

There has been a thirteen-fold increase in the enrollment of students of chemical engineering in universities and colleges, said Prof. Albert B. Newman of Cooper Union, New York City, recently. Statistics on present freshman enrollment place chemical engineering second only to mechanical engineering in number of students, with electrical engineering third and civil engineering fourth. Today 12,000 students in the United States are studying chemical engineering

In an experiment with electric lighted traps, it was found that blue colored light was most alluring to mosquitoes, gnats, and midges.

SIX BIG AUTO BOOKS

shipped FREE for examination

Here is a wonderful offer for anyone who wants to know more about automobiles. Whether you want to keep your own car in perfect condition or make more money by learning all about design, upkeep and repair, you should have these books. Our amazing FREE SHIPMENT offer puts them into your hands for examination without paying us one cent. Read them. Look them over. Use the jiffy index which enables you to put your finger on wanted facts instantly. Then decide whether or not you want to keep them.

Practically every auto fact is covered. Diesel engines, aviation motors, outboard motors, motor cycles, tractors, superchargers and other up to date features are all included. In addition they tell you how to do every auto job RIGHT the FIRST TIME.

Make More Money

Why not qualify for a BIG PAY JOB? Be the man who knows the answers. Be a foreman, superintendent or manager. Over 23 million auto owners need men who know how, who don't have to guess to find out what's wrong and who can fix it quickly. Learn auto engineering with these wonder books without studying or memorizing. Use the jiffy index to look up the answer to any auto problem.

6 Big volumes bound in gold stamped flexible binding. Over 2600 pages, 2000 illustrations, wiring diagrams, equipment charts, etc. Printed on fine paper in extra clear type with the famous jiffy index for quick fact finding. Here are the most up to date automobile books ever published.

AMERICAN TECHNICAL SOCIETY
Drexel Ave. at 58th St., Dept. AC320. Chicago, Ill.

Can You Fix It?

Can you adjust knee action and other phases of modern automobile construction? Do you now the details of automatic gear shifts, booster brakes, and other newer items of equipment? Can you handle a DIESEL job? In short, are you up to the minute on automobile design and repair? In these days you must know the answers to make the BIG MONEY. These books which we offer to send you FREE FOR EXAMINATION cover the entire automobile field including Service Shop Management.

CONSULTING MEMBERSHIP INCLUDED If you send for these books NOW on our free examination offer we will include a consulting membership in the American Technical Society good for one year. You have the services of our staff of experts without charge. Write or wire for information on any difficult problem. A reply will be sent promptly at no cost.

AMERICAN TECHNICAL SOCIETY
Drexel Ave. at 58th St., Dept. AC320, Chicago, Ill.

I would like to see the 6-volume edition of your AUTO BOOKS. I will pay the few cents delivery charges only. If after 10 days' use I decide to keep them, I will send you $2 and pay the balance at the rate of only $3 a month, until $24.80 is paid. Otherwise I will return the books and owe you nothing. Include FREE, consulting membership as per your offer above. Send BRAND NEW edition including DIESEL.

Name.....

Address.....

City.....State.....

Please attach letter stating age, occupation and name and address of employer and at least one business man as reference.

Learn Advertising at Home

Make money in advertising. Prepare quickly during spare time. Also earn while you learn. No experience necessary. New, easy method. Nothing else like it. Send at once for free booklet—"Win Success in Advertising," and requirements. No obligation.

Page-Davis School of Advertising
3601 Michigan Avenue, Dept. 205-C, Chicago, Illinois, U. S. A.

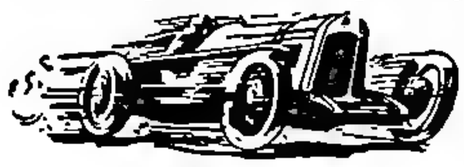
One Wire Electric FENCE Only $9.75 COMPLETE

Fencing Cost Only $5 Mile

Complete Electric Fencer—only $9.75 complete with insulators! Sharp but harmless electric "sting" holds all live stock safely and securely. Three dry cells last many months. Satisfaction guaranteed. Details free. **SENTINEL, Dept. L-916, 4220 Davis Lane, Cincinnati, Ohio.**

Automobile Racing Book (Fourth Edition)

Nine chapters, 66 illustrations of dirt, midget, and championship cars and drivers. How to build cars and bodies; 14 plates working drawings. Ford V-8 front drive racer illustrated and described. Book answers questions on speeding up cars, balance, speed revs., rules, specifications, track records, etc. Postpaid $1.00; C.O.D. $1.15. Order NOW!



RAY F. KUNS, Dept. A-20
Madisonville, Cincinnati, Ohio

$ NEED MONEY?

Write for free booklet describing "107 Plans for Operating a Successful Business of Your Own". Make from $20 to $100 a week starting in spare time at home. No peddling or house-to-house selling. Booklet sent *free*, and *without obligation*. Write for your copy *today*.

ELITE PUBLISHING CO.
Dept. G 214 Grand St. New York, N. Y.

FREE BOOK

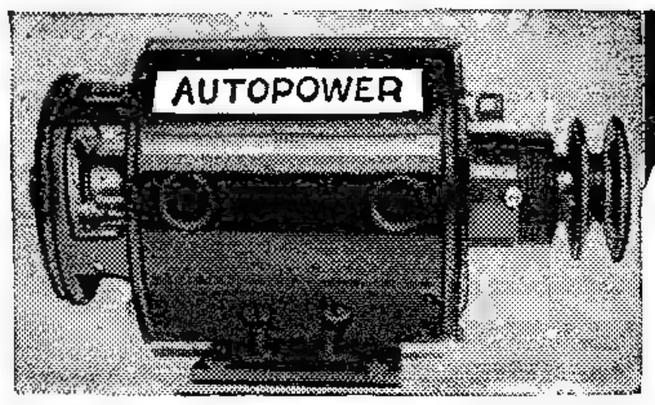
PLASTEX

The Plastex Industry needs manufacturers on small scale and for big production of Art Goods, Novelties, Souvenirs, etc., in Plastex and Marble Imitation. Experience unnecessary. Equipment and simple instructions furnished for speed production. Small investment brings big returns. Nation-wide demand for these low priced goods. Ambitious men have chance for real prosperity. Our free book will interest and benefit you. Big wholesale season now starting. **PLASTEX INDUSTRIES, Dept. 3, 1085 Washington Ave., New York, N. Y.**

FREE RADIO AND PARTS CATALOG!

See the latest sensational radio developments in Allied's new 1938 Radio Catalog! 61 new KNIGHT Radios at amazingly low prices; 12,000 radio parts; 32 new Build-Your-Own kits; Amateur gear; P.A. Systems; books, tools, etc. Write today for FREE copy!

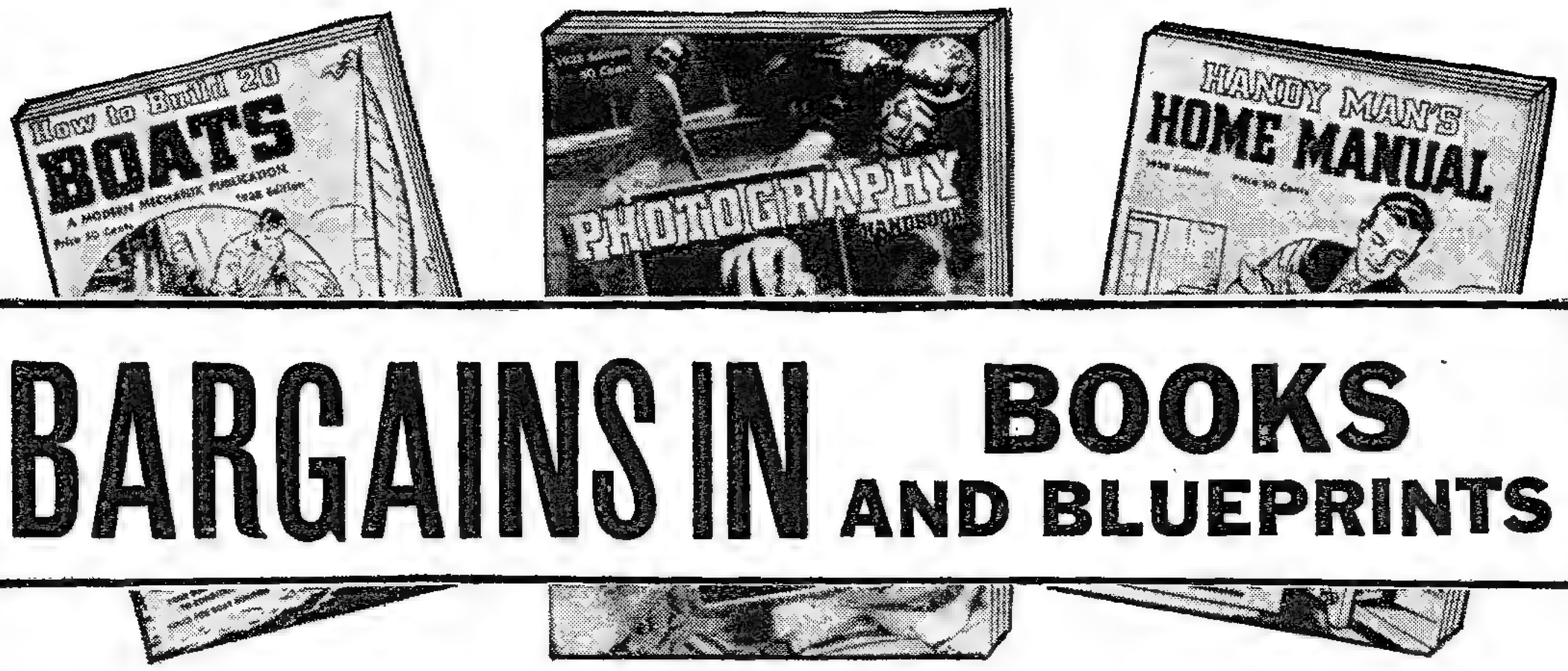
ALLIED RADIO CORP.
833 W. Jackson Blvd., Chicago, Ill., Dept. 6-H-38



TURN SCRAP INTO MONEY

AUTOPOWER tells you how in plain, easy, simple and illustrated instructions that anyone can follow. Change auto generators into useful, practical A C and D C generators and motors with voltage from 2 to 1,000 volts, for power, light, welding, radio, sound, etc. No previous experience nor special tools needed. Generators can be driven by wind, water, fan belt, etc. INSTRUCTIONS FOR BUILDING AN A C WELDER THAT ACTUALLY WORKS UP TO A 3/16" ROD. ALSO COMPLETE PLANS FOR WIND AND WATER POWER PLANTS. Send for your copy of "AUTOPOWER." Already used and endorsed by thousands. Only $1.00 postpaid.

S. W. DUNCAN, Publisher **412 S. Hoyne Ave., Chicago**



BARGAINS IN BOOKS AND BLUEPRINTS

These MECHANIX ILLUSTRATED Books Will Help You To Get Maximum Benefit From Your Hobby Or Workshop

HOW TO BUILD 20 BOATS

Plans and construction details for easy-to-build boats ranging in size from 7 to 27 feet, and a wealth of incidental information for the man who already owns one. Complete instructions for reconditioning boats, handikinks, navigation tips, etc. 144 pages, price 50c

PHOTOGRAPHY HANDBOOK

A complete photo manual that tells in non-technical language how to develop, print and enlarge films; how to make your own darkroom equipment at small cost; how to improve your camera and how to make good pictures. No matter what kind of a camera you own you will find this book an invaluable aid. 144 pages, price.....50c

HANDY MAN'S HOME MANUAL

You don't have to be an expert mechanic to keep your house in tip-top condition. Secure a copy of this book and you'll save its cost over and over by learning to make simple repairs and improvements without the need of calling in outside help for it is filled with practical how-to-make, how-to-improve and how-to-repair kinks. 144 pages, price 50c

CUT OUT AND MAIL TODAY!

FAWCETT
PUBLICATIONS, INC., Dept. M
GREENWICH, CONN.

Enclosed find money order, check or stamps. Please send me, postpaid, the book(s) I have checked below at 50 cents per copy:

- ☐ How to Build 20 Boats
- ☐ Photography Handbook
- ☐ Handyman's Home Manual
- ☐ Sportsmen's Annual
- ☐ How to Build Trailers
- ☐ How to Build It

I enclose three cents to cover postage for free Blueprint Catalog.

Name .....

Address .....

SPORTSMEN'S ANNUAL

Do you fish, hunt, or camp? If you do, you'll find this book a veritable encyclopedia of outdoor information—new angles for the angler, handikinks for the sportsmen and new ideas for campers. You'll like this profusely illustrated outdoor book. 144 pages, price 50c

HOW TO BUILD TRAILERS

Follow the open road in trailer built by yourself. This book features complete plans and construction details for building seven different cabin trailers, two boat trailers, delivery trailers and many trailer kinks, shortcuts and camping tips. 144 pages, price 50c

HOW TO BUILD IT

Whether your workshop is small or large, you'll find projects in this book that will supply ample outlet for your skill with tools. Complete plans and construction details for building a midget auto racer, model locomotive, gas-powered airplane, playground equipment, toys, etc. 144 pages and the price is only.....50c

ALL BOOKS SENT POSTPAID

FREE!—

A copy of the MECHANIX ILLUSTRATED Blueprint Catalog will be sent to you free upon receipt of a three-cent stamp to cover mailing. The catalog lists all available MI blueprints and many technical and hobby books.

FAWCETT PUBLICATIONS, INC.
Fawcett Building :: Greenwich, Conn.

Obsolete Plane Protects Ohio Fruit Orchards From Frost

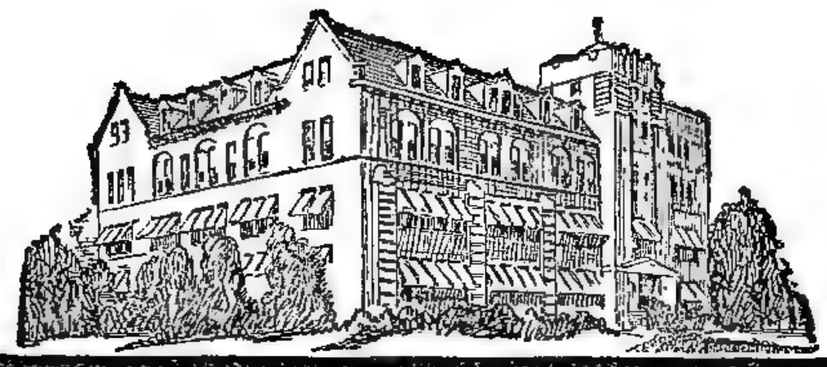
Mounted atop a 40-foot steel tower on a fruit farm near Painesville, Ohio, an obsolete wingless airplane is being used to prevent dew from forming on trees and freezing, thus damaging the orchards. When the temperature falls a bon-fire is lighted, sending up heated air which is blown over the orchards by the propeller of the airplane.

Missing Comet Rediscovered By Harvard Astronomer

Gale's comet, missing from the region of the sun and earth for eleven years, has been rediscovered by astronomer L. E. Cunningham of Harvard College Observatory in Cambridge, Mass. This comet, too faint to be seen with the unaided eye, was first found on June 7, 1927, by Walter F. Gale, a justice of the peace in Sydney, Australia, who observes stars in his spare time. The probable return of Gale's comet this spring was forecast last January by Science Service.

As seen from the United States, the Gale comet is low in the southeast sky about 10 degrees above the horizon. It is near the constellation of Ophiuchus, the serpent bearer. A neighboring constellation, perhaps more easily located, is Scorpius containing the brilliant star Antares.

The rainbow tinted film of oil seen on a rain puddle on the pavement is only one millionth of an inch thick.



High School Course at Home

Many Finish in 2 Years

You can complete this simplified High School Course as rapidly as your time and abilities permit. Equivalent to resident school work—prepares you for entrance to college. Standard H. S. texts supplied—Diploma. Credit for H. S. subjects already completed. Single subjects if desired. High School education is very important for advancement in business and industry and socially.

College Entrance

During the past 14 years, our High School graduates have been admitted to 531 different Universities, Colleges, Junior Colleges and Normal Schools—80% of them without entrance examination. Course also prepares for teachers' certificate and pre-professional examinations.

Business—Industry

To get and hold a good position in Business today you must be able to write clear, accurate letters and reports—do figuring involving Algebra and Geometry—talk intelligently on matters requiring a knowledge of Geography, History, and Economics.

In Industry—Mechanical and Engineering lines—you must have at least an elementary knowledge of Physics and Chemistry—be able to figure quickly and accurately—know something of Mechanical Drawing and blueprints—and be able to talk and write accurately and clearly on both your work and ordinary topics of conversation.

Our High School course meets the preparatory educational requirements for Business and Industry.

An Educational Institution

The American School was chartered in 1897 as an educational institution, not for profit—and is exempt from paying Federal income tax, like the best resident colleges and universities.

Don't Be Handicapped—Complete Your Training Now

Be a High School Graduate! Prepare yourself for promotion in Business and Industry—for the Professions, College Entrance and social success. No matter what line you may select, High School training will prove invaluable to you! Our moderate fees cover all instruction, standard textbooks and Diploma. Easy monthly terms. Get ahead in life. Start your training NOW!

20 Other Courses

Over 150 noted Educators, Engineers, and Business Men helped prepare our special instruction material, which is used by many resident schools and colleges, U. S. Navy, and Province of Manitoba, Canada. We offer you quality training at home for the best-paying lines of Industry and Business, as listed in the coupon.

Mail coupon for information about line that interests you

American School, Drexel at 58th, Chicago

American School, Dept. HC28, Drexel at 58th, Chicago
Tell me how to train for success in line checked. No obligation.

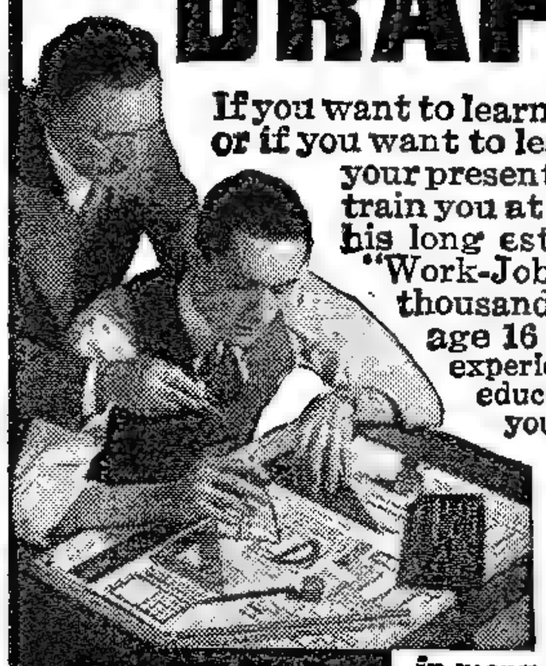
☐ High School Course

☐ Accounting & Auditing	☐ Diesel Engineering
☐ Architecture & B'lding	☐ Drafting & Design
☐ Automotive Engin'ring	☐ Liberal Arts
☐ Business Management	☐ Private Secretary
☐ Com'ercial Aeronautics	☐ Hi'er Ac't'g (C.P.A.)
☐ Electrical Engineering	☐ Highway Engin'r'g
☐ Electrical Refrigerat'n	☐ Mechanical Eng'r'g
☐ Air Conditioning	☐ Radio & Television
☐ Civil Engineering	☐ Salesmanship
☐ Complete Law	☐ Steam Engineering

Name_____

Address_____

Let Engineer DOBE TRAIN YOU AT HOME FOR DRAFTING!



If you want to learn drafting as a profession—or if you want to learn drafting to advance in your present work—Engineer Dobe can train you at home in your spare time by his long established, proven-practical "Work-Job" Method. He has trained thousands of successful students, age 16 to 18 to past 50. Previous experience not required. High school education not needed. He offers you a real opportunity to get a complete training in drafting right in your own home in a surprisingly few months. Engineer Dobe teaches his students until thoroughly trained and until holding a good paying job. Drafting offers big opportunities in many fields. Mail the coupon **today** for FREE illustrated book "Successful Draftsmanship" and full details of Engineer Dobe's remarkable offer that includes all necessary tools and equipment.

ALL TOOLS FURNISHED When You Start!

Engineer Dobe, Div. C474 Libertyville, Ill.

Send for FREE BOOK

Send me your free book "Successful Draftsmanship." Please explain how you assist your graduates to good positions as draftsmen.

Name .....

Address .....

Town ..... State..... Age.....

GET HEP TO FUN!

Don't be lonely! Get in on the big fun. Pal with other riders. Join your local motorcycle club. Go places and do things with the bunch! See your Harley-Davidson dealer—he'll tell you how to join. Send for full particulars of the latest models, and for free magazine. **HARLEY-DAVIDSON MOTOR CO., Dept. MI-838, Milwaukee, Wis.**

HARLEY-DAVIDSON

Motorcycles

Diesel

For several years, Diesel engines have been replacing steam and gasoline engines in power plants, motor trucks and busses, locomotives, ships, tractors, dredges, pumps, etc. And now the first Diesel-powered passenger car is on the market. Our home-study course offers you a real opportunity to prepare for a worth-while position in this new field. Write TODAY for full information. No obligation.

American School, Dpt. DC 28, Drexel at 58th, Chicago

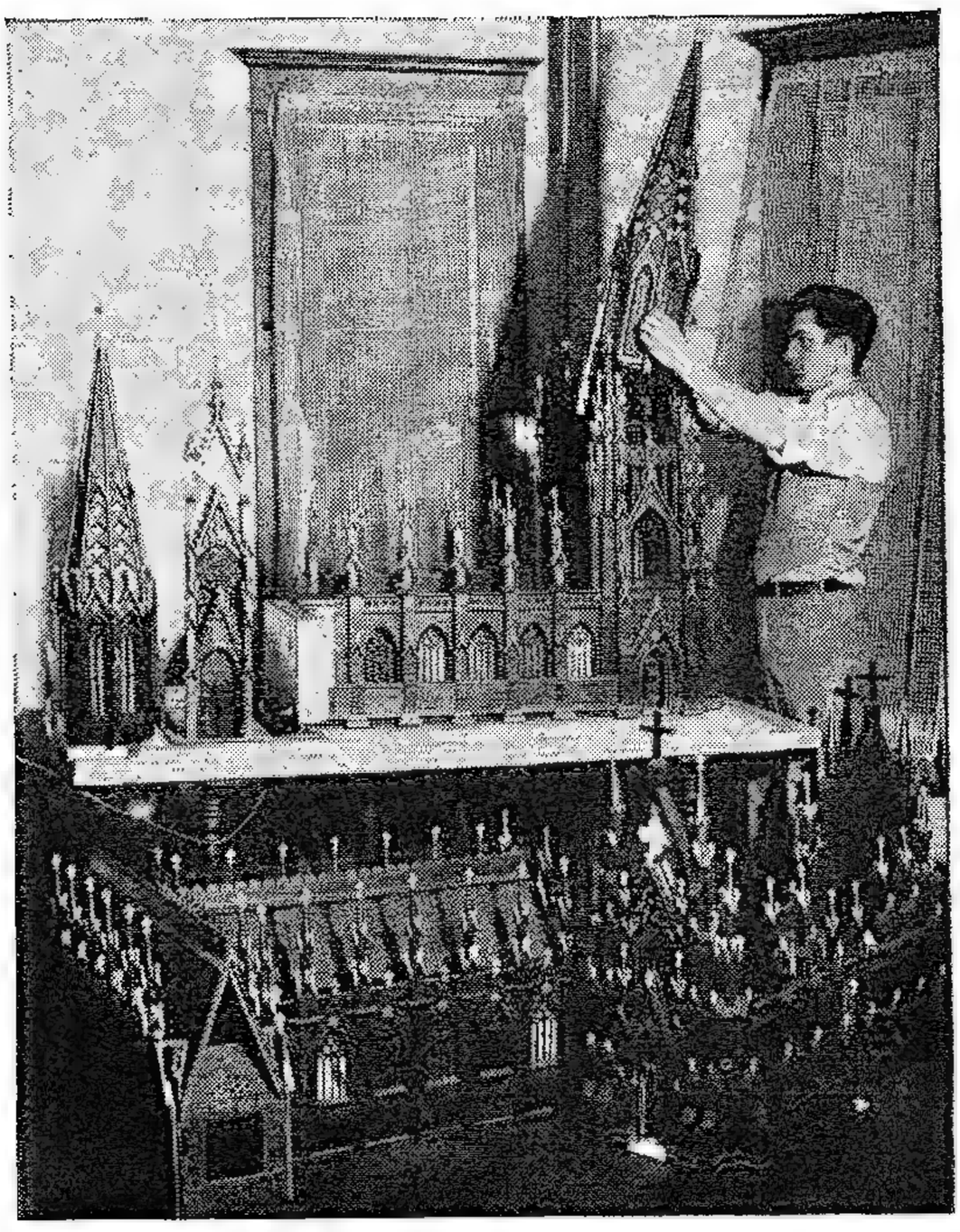
DID YOU MAKE $50 LAST WEEK?

If not, investigate this opportunity to get into a Big-Pay business of your own. Show merchants plan that increases sales, profits. Handle Nationally Advertised Line 5c—10c goods. Put up on self-help Counter Displays. 200 daily necessities. Included is Laymon's Aspirin—approved by Good Housekeeping Bureau—and famous Twenty Grand Razor Blades. Hundreds of men earning big incomes handling our fast-selling line. Start small—grow fast. FREE book tells how you can build big-pay store route. Write for it today!

Have a BIG-PAY STORE ROUTE

WORLD'S PRODUCTS COMPANY
Dept. 8814, Spencer, Indiana

Builds Detailed Scale Model Of Famous Cathedral



Comprised of 16,352 pieces of ordinary boxwood, a five and one-half-foot high detailed scale model of New York's famous St. Patrick's Cathedral has been constructed by Felix Gurney, of Chicago, Ill. The model represents spare-time work since September, 1934, and was built from photographs of the prototype, no plans being available. Only simple tools such as a hammer, saw, soldering iron and a knife were used.

Measured Speed Of Insects Reviewed By Scientist

A mile a minute is the fastest an insect has ever been observed to fly over a measured course. This was done by an Australian dragonfly, whose speed over a distance of between 80 and 90 yards was clocked at three seconds, by the well-known New Zealand entomologist, Dr. R. J. Tillyard. Other scientists, using various methods, have determined the speeds of flying insects belonging to various orders at from 18 to 33 miles an hour.

A review of these authentically measured insect speeds was recently published by Dr. H. E. Ewing, U. S. National Museum entomologist, in commenting on the claimed speed of over 800 miles an hour by a Mexican deer botfly, which was recently exploded by an engineer, Dr. Irving Langmuir, of the General Electric Company's research laboratories.

Chemical Research Expands Use Of Wood Products

New and more efficient methods of utilizing world's forests are permitting the wood products industry to approach the high efficiency of meat packers who boast that they use everything but the pig's squeal.

Besides the time-honored uses of trees for lumber and fuel, the forests are now looked upon as a source of raw materials for cellulose derivatives, paper pulp, staple fiber, naval stores, wood distillation products and ingenious wood plastics, it was indicated in an address by Dr. H. K. Benson, professor of chemical engineering, University of Washington, in Seattle, before a joint meeting of the International Union of Chemistry and the International Congress of Chemistry held in Rome, Italy.

Chemical research on the uses of wood has brought about the necessary conditions for an integrated forest policy and forest industry. Forest management, producing yields on a sustained basis, is likely to be adopted more than ever, Prof. Benson said. Where once a sawmill operated alone there are now frequently added a planing mill, a by-products wood distillation plant, a wood creosoting plant and a pulp mill.

Spruce, which long was the dominant species of wood used in paper-making, is now displaced by other trees, Prof. Benson pointed out. It has dropped consistently from 75 per cent, in 1900 to 50 per cent in 1925, and was down to 31.2 per cent in 1935. Western hemlock, available in large stands in the Northwest, is the chief competitor of spruce.

The annual growth of pulp species of trees in western Oregon and in the state of Washington amounts to 264,000,000 cubic feet, equivalent to 1,500,000 tons of chemical wood pulp and thus more than the present annual import from other nations of sulfite fiber for paper making.

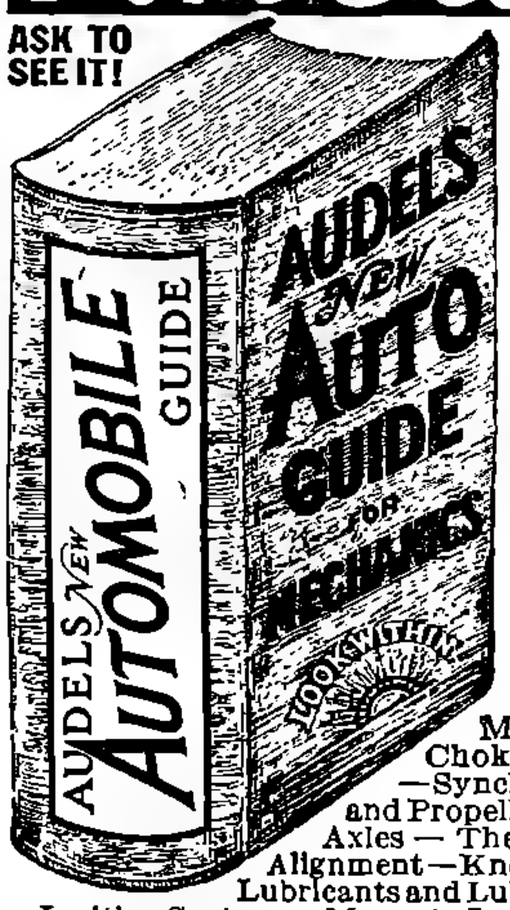
Through chemistry, he added, the supplies of pine trees in the South and the giant Douglas firs in the West are also both becoming available as sources of paper pulp. Twenty-seven pulp mills are either established or assured in the region south and west of North Carolina. The 1938 expected output of these plants is estimated 20 per cent of the entire demand for sulfate pulp.

The electric eye can be used to open dental cabinet drawers, permitting the dentist to open a drawer without risk of transferring germs from his hand to the cabinet.

With all the remarkable metals ingeniously used by man, we are still dependent on iron, since far more iron is used than any other metal.

Know! YOUR CAR

ASK TO SEE IT!



GOOD NEWS—JUST OUT

1938 AUDELS NEW AUTOMOBILE GUIDE is NEW from cover to cover. Explaining the Theory, Construction and Servicing of modern motor cars, trucks and buses; and the application of auto type Diesel Engines. . . . PRACTICAL INFORMATION IN HANDY FORM, 1540 PAGES COVERING . . .

AUTO REPAIRS & SERVICE HELPS

All the Parts of an Automobile—Automotive Physics—The Gas Engine—How a Gas Engine Works—Gas Engine Principles—Multi-Cylinder Engines—Horse Power—Automobile Engines—Engines: Stationary Parts—Engines: Moving Parts—Pistons—Piston Rings—Connecting Rods—Crank Shafts—The Valves —The Valve Gear —Cams and Cam Action—Valve Timing—Cooling Systems—Gasoline — Fuel Feed Systems — The Mixture—Carburetors—Automatic Choke—Super-Chargers—Transmissions —Synchro-Mesh— Clutches — Universals and Propeller Shafts—The Differential—Rear Axles — The Running Gear — Brakes — Wheel Alignment—Knee Action—Steering Gear—Tires—Lubricants and Lubrication—Automotive Electricity —Ignition Systems—Magneto Ignition—Spark Plugs—Ignition Coils --Distributors--Automatic Spark Control--Ignition Timing--Generators--Starters --Generator and Starter Testing--Lighting Systems--Storage Batteries--Battery Charging -- Battery Testing Troubles. **Automotive Diesel Engines. Inside Views of all Automobile Parts Fully Illustrated. To Get This Assistance for Yourself Simply Fill In and Mail Coupon Today.**

$4 COMPLETE • PAY ONLY $1. A MONTH ←

THEO. AUDEL & CO., 49 WEST 23rd STREET, NEW YORK

Please send me postpaid AUDELS NEW AUTOMOBILE GUIDE ($4) for free examination. If I decide to keep it, I will send you $1 within 7 days; then remit $1 monthly until purchase price of $4 is paid. Otherwise, I will return it to you promptly.

Name .....

Address .....

Occupation .....

Reference MM4

U.S. GOVERNMENT JOBS.

START

$1260 to $2100 Year

Common Education Usually Sufficient

Government File Clerks
Stenographers—Typists
Accountants
Post-Office Positions
Customs Positions
Etc.

GET READY IMMEDIATELY.

Mail Coupon today— SURE

COUPON

FRANKLIN INSTITUTE
Dept. T262
Rochester, N. Y.

Rush to me, entirely free of charge, 32 page book with: (1) A full description of U. S. Government jobs; (2) A list of U. S. Government Jobs; (3) Tell me how to qualify for a job.

Name .....

.....

.....

Thrilling NEW

EVINRUDE "Ranger"

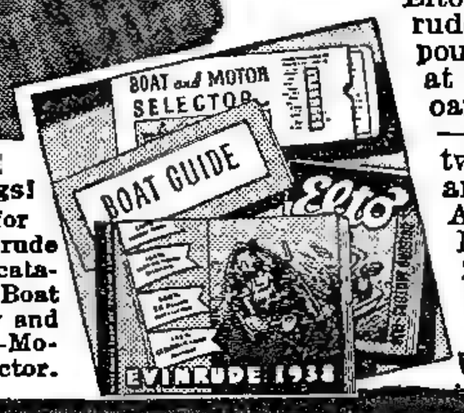
ONLY $47.50

A brand new Evinrude . . . amazingly light, handy and powerful. Weighs only 16 lbs., and cruises 3 hours on a single fill! Literally *packed* with big-value features including famed Hooded Power — Evinrude Co-Pilot — Underwater Silencing. Starts *instantly!* — spins into action with a flick of the starting cord. Costs less than 3¢ an hour to operate. Send for catalog!

ELTO PAL *only* $37.50

Elto PAL (built by Evinrude) weighs only 14 pounds, and drives boats at twice the speed of oars. Elto ACE, $47.50 — the husky Handi-twin, only $67.50. Each an outstanding value! Address EVINRUDE MOTORS, 5522 N. 27th St. Milwaukee

Prices F. O. B. Factory



FREE Catalogs! Write for 1938 Evinrude and Elto catalogs . . . Boat Directory and Boat-and-Motor Selector.

EVINRUDE OUTBOARD MOTORS

LAW STUDY AT HOME

Legally trained men win higher positions and bigger success in business and public life. They command respect. Greater opportunities now than ever before. Big corporations are headed by men with legal training.

More Ability: More Prestige: More Money

We guide you step by step. You can train at home during spare time. Degree of LL. B. conferred. Successful graduates in every section of the United States. We furnish all text material, including fourteen-volume Law Library. Low cost, easy terms. Get our valuable 64-page "Law Training for Leadership" and "Evidence" books FREE. Send for them NOW.

LASALLE EXTENSION, Dept. 8493-L **Chicago**

Earn Cash at Home!

We paid M. M. $1174 for exceptional "cellar crop" SNOW-KING mushrooms! Big free picture book tells if your cellar, shed, barn, suitable. We furnish materials, buy all crops through our 25 branches. Write today for "Guaranteed Success Plan" backed by $5000 bond. Est. 1908.

UNITED MUSHROOM CO.

3848 Lincoln Ave., Dept. 317 Chicago.

LEARN

YOU LET US! TEACH YOU AT HOME

NEW COURSE **SIGNS SHOW CARDS** EASY TO LEARN

POSTER AND ALL FREEHAND LETTERING

EARN

Write Dept. A

REGINA SCHOOL OF LETTERING

77 W. Washington St., Chicago, Ill.

Explore NEW ROADS

You can get a thrill out of driving again. Try the less frequented highways. Let the Hull Auto Compass direct you along any unfamiliar road any time, in any weather. No worry, no delays. Only $2.95 at your dealer. Two-piece model $1.95. Write for circular.

HULL MFG. CO., P. O. Box 246-M4, WARREN, OHIO

NEW TYPE BUILDER'S LEVEL

Complete Outfit $6.00

For all building and construction work, footings, foundations, grading, sewers. Well made, accurate, convenient. There is nothing cheap about this level but the price. Particulars on request.

Prout Mfg. Co., P. O. Box 127-M, Villa Park, Ill.

No Joke To Be Deaf

—Every deaf person knows that—

Mr. Way made himself hear his watch tick after being deaf for twenty-five years, with his Artificial Ear Drums. He wore them day and night. They stopped his head noises. They are invisible and comfortable, no wires or batteries. Write for TRUE STORY. Also booklet on Deafness.

Artificial Ear Drum

THE WAY COMPANY

741 McKerchey Bldg. Detroit, Michigan

AVIATION APPRENTICES

BIG PAY **GOOD FUTURE**

If you are interested in training yourself for a highly paid position in the aviation industry—Write, immediately, inclosing stamp.

MECHANIX UNIVERSAL AVIATION SERVICE CO.

Strathmoor Station Dept. A Detroit, Mich.

MAN IN EACH TOWN

To Plate Auto Parts

Reflectors, Bicycles, Fixtures, Mirrors, by late method. Simple plan of manufacturing at home starts you IN GOOD PAYING BUSINESS. Write today for FREE particulars and proofs.

GUNMETAL CO.,

Ave. P. Decatur, Ill.

---

9 HOURS TO BUILD *NEW* SPORTSMAN'S BOAT!

MEAD Sportsman's Ki-Yak is the most *sensational* boat development in years. Exclusive *new* structural features set a new standard for lightness, strength, durability, beauty and ease of assembly. Easily portable. *Low introductory prices!* 3 paddle-sail models weighing 20 to 45 lbs.—2 models of 50 and 69 lbs. for outboard motors, oars, sail. Don't deny yourself the pleasure of knowing all about Mead Ki-Yaks. **Rush** 10c for Catalog. $6 Paddle now given with your "CK" Ki-Yak Kit—*if you hurry!*

MEAD GLIDERS 15 So. Market Dept. M-88 **CHICAGO**

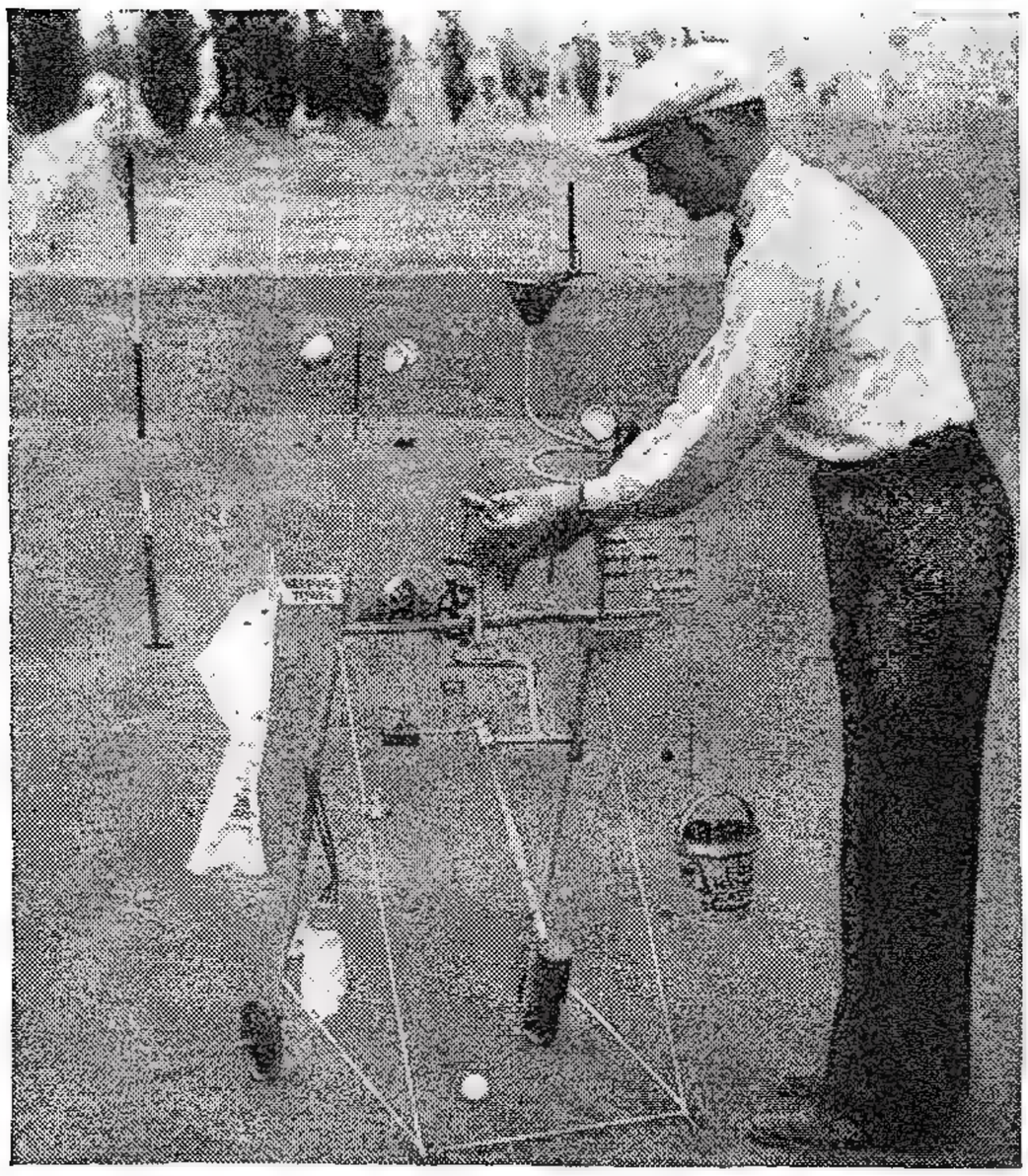
WILL YOU WEAR THIS SUIT and Make up to $12 in a Day!

Let me send you a fine all-wool union tailored suit **FREE OF ONE PENNY COST.** Just follow my easy plan and show the suit to your friends. Make up to $12 in a day easily. **No experience—no house-to-house canvassing necessary.**

Send for Samples—FREE OF COST

Write today for FREE details. ACTUAL SAMPLES and "sure-fire" money-getting plans. Send no money. **H. J. Collin, PROGRESS TAILORING CO., Dept. H-137, 500 South Throop Street, Chicago, Illinois.**

Home-Built "Precision Putter" Amuses Golf Enthusiasts



Developed by a golf enthusiast in La Habra, Calif., to entertain and amuse his fellow players, the novel device shown above is known as a "Precision Putter". A few of the device's attachments are: an astigmatic telescope for sighting the hole on the green, an annemometer for determining wind velocity, a spring-operated mallet for striking the ball, a weeping towel for those who miss their shot, and a can of oil for lubricating the putter's mechanism.

Sound Removes Gases From Molten Glass

Supersound waves, above frequencies audible to the human ear, are an effective agent for the removal of poisonous gases dissolved in molten glass and which must be removed for reasons of safety, a scientist, Dr. Krueger of Greifswald, Germany, declared at a recent "glass technique convention."

The high frequency waves cause dissolved gas to form minute bubbles, which grow until they are carried away by ordinary draughts of air, he declared. The system is in use in several German glass-blowing plants.

At the bottom of the Atlantic Ocean there is a tremendously long mountain range which extends from the Arctic to the latitude of South America's tip.

Air-Conditioning Books *shipped* **FREE** *on approval*

Grab this opportunity to get the most up to date information on this new profession, which is bound to revolutionize building. From start to finish these 6 great books cover the whole field, from air conditioning old houses, converting old heating systems to the proper method of design and installation for use in the most modern buildings. It won't be long before every carpenter, every architect, every plumber or anyone who has anything to do with building will be expected to be fully familiar with the science of air conditioning. Here is your opportunity to get this information FREE for trial.

Over 2000 Pages-800 Illustrations

These books are beautifully bound in modernistic binding simulating leather and are chock full of invaluable information for any one in the building field. Whether you are a beginner or an expert, you should have a set of these books which will be sent to you upon our FREE examination offer. Send the coupon—the full set of 6 big volumes will be forwarded promptly.

Membership —FREE—

Send now and we will include a membership in the American Technical Society giving privilege of consultation with our engineers for one year on any difficult problem without cost.

New Money Making Profession

Air conditioning is new but it is already in great demand and men who are smart enough to get into this work now are bound to profit by their foresight. Up to now very little information has been available. Men who knew much about the subject have guarded this information jealously, but here is the most up-to-date information and it all comes to you without any obligation other than to examine it before you decide whether or not you want to keep the books. Don't delay. Be the first in your locality to fit yourself for a profession which will probably grow like wildfire as soon as the coming building boom gets under way. Send the coupon today.

American Technical Society
Drexel Ave. & 58th St., Dept. KC320, Chicago, Ill.

I would like to see the new 6-volume edition of your Air Conditioning Books. I will pay the few cents delivery charges only, but if I choose to, I may return them express collect. If after 10 days use I prefer to keep them, I will send you $2 and pay the balance at the rate of only $3 a month, until $24.80 is paid. Please include free consulting membership as per your offer above.

Name .....

Address .....

City ..... *State* .....

Attach letter stating age, occupation and name and address of employer and that of at least one business man as reference.

work faster

ALL-PURPOSE MOTO-TOOL

Model 1 $9.85 postpaid 10 Day Trial

Everyone who works with his hands—at home, shop, school, or profession—can use the efficient, attractive Moto-Tool to advantage. Grinds, drills, routs, carves, polishes all materials. Chuck uses many tools. You do in seconds jobs that require hours of hard, hand work. Safe, thousands in use. Two fine models. No. 1 weighs 6 oz.—about 20,000 r.p.m. No. 2 weighs 13 oz.—about 25,000 r.p.m. Order on 10 day money back trial, or send for free booklet.

DREMEL MFG. CO.
1032CT
Racine, Wis.

Model 2 $16.50 Postpaid

ARREST HIM, OFFICER!
I'LL HAVE COMPLETE FACTS ON THE OTHER FELLOW TONIGHT!

Secret Service Operator No. 38 is on the job . . . FOLLOW HIM through all the excitement of his chase after the counterfeit gang. Write NOW for

FREE Confidential Reports No. 38 Made to His Chief!

It may open your eyes to the great opportunity for YOU as a well paid Finger Print Expert. The kind of work you'd like. Excitement! Travel! Thrills! A REGULAR MONTHLY salary, REWARD MONEY. Graduates of this school HEAD 47% of all Identification Bureaus in U. S.! Write for Free Reports, Finger Print Book, low prices. Easy Terms Offer, if 17 or over.

Literature will be sent only to persons stating their age.

INSTITUTE OF APPLIED SCIENCE
1920 Sunnyside Ave., Dept, C-235, Chicago, Ill.

Classified Advertisements

Rate for classified ads, 18c per word (Include name, address and all numbers), per insertion. Minimum 10 words. Cash must accompany order and be received in this office July 1st for the September issue (on sale August 10th). Address Classified Mgr., Mechanix Illustrated, 1501 Broadway, New York City.

A. C. GENERATORS

PRACTICAL changes for automobile generators. A. C. and D. C. generators, motors and welders. Complete wind and water power plants. See our advertisement at bottom of page 21. Autopower.

ADVERTISING AGENCIES

ADVERTISE in 2,825,000 magazines, $1.60 per word. Minimum words, 20; maximum, 120. Count words, initials, numbers in ad and address. Inclose money order. Reginald Allen, 501 Thames, Newport, Rhode Island.

ADVERTISE your products through selected mediums! Free Manufacturing recommendations. If it can be sold we can sell it. Write giving all information. Arrow Advertising, Kearney, Nebraska.

MAIL-ORDER Ad reaching 1,500,000 families throughout United States $15.40 inch. Newspaper, magazine, ratebook free. Chicago Advertising Agency, 20-M West Jackson, Chicago.

ADVERTISE: 24 words in 250 Newspapers $10. Lists Free. Advertising Service Bureau, 4515-B Cottage Grove, Chicago.

FREE NEW advertisers rate guide. Brown Advertising Agency, 140 South Dearborn, Chicago.

AGENTS WANTED

SELL 50 Personal Christmas Cards—$1.00. Amazing bargain! 50 folders with customer's name imprinted. Sells fast. Pays big profit. Free Samples. Also unequaled $1 Christmas Card Assortments. General Card, 400 S. Peoria St., Dept. P-324, Chicago.

AGENTS: Smash go prices! Santos Coffee 12c lb. 4-oz. Vanilla 8½c. Razor Blades 10 for 8½c. 100 Sticks Chewing Gum 12c. Christmas Cards, 21 in box, 14c. 150 other bargains. Premiums. Experience Unnecessary. Carnation Co., MN, St. Louis, Mo.

I'LL GIVE YOU groceries at wholesale besides splendid opportunity to make up to $45.00 in a week. Brand new Ford Sedan given as bonus. Details free. Albert Mills, 6203 Monmouth, Cincinnati, Ohio.

PROFIT with new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, CE-1142 Sunnyside, Chicago.

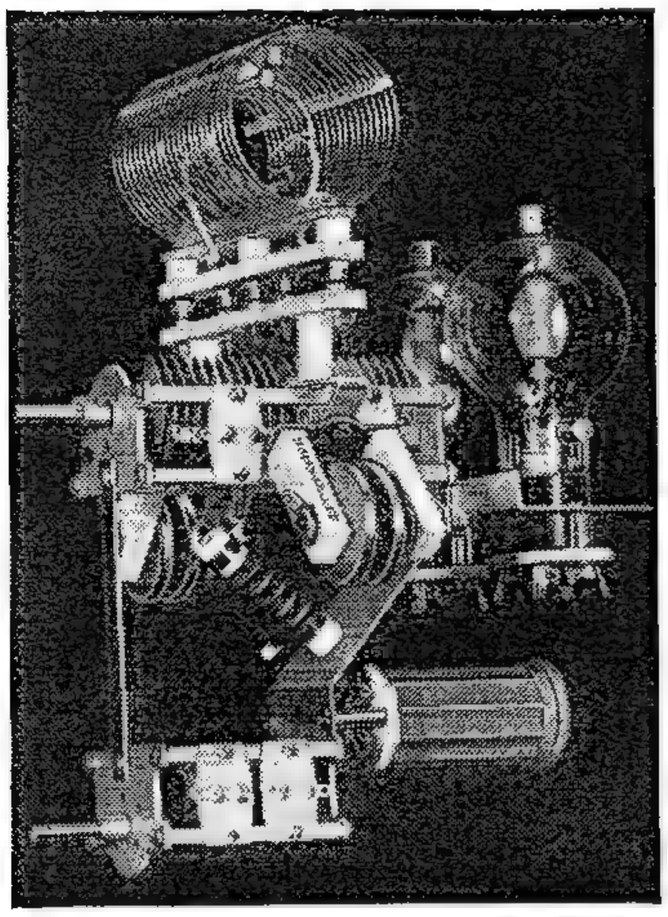
BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for name plates and tire cover transfers. "RALCO", 1305 Washington, Boston, Mass.

AMATEUR Camera Fans: Up to $50 weekly with your kodak. Send 25c for booklet describing 100 markets for photos. Holman, Box 575, Minneapolis, Minn.

1000 BARGAINS. Drygoods, Notions, Drug Sundries. Specialties, Novelties. Agents undersell stores. Free catalog. Jobbers, Dept. 3298A, 930 W. Roosevelt, Chicago.

WHERE To Buy At Wholesale 500,000 articles. Free Directory and other valuable information. Maywood MM. Publishers, 925 Broadway, New York.

New Unit Aids Transmitter



The unit shown above is a push-pull radio frequency power amplifier designed to use any of the popular triode tubes having ratings of from 100 to 300 watts output per pair. All parts associated with the amplifier proper, are joined together with brackets of various shapes. This hardware is available in kit form and the only tools necessary for assembling and wiring are a screw driver and soldering iron. When finished, it is a self supporting unit which can be bolted to a panel with the mounting screws furnished with the variable condenser; no chassis is necessary.

BIG money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 11, Dunellen, New Jersey.

BUSINESS Proposition Resilvering Mirrors. Autoparts, Reflectors, Making Chipped Glass Signs. Write Sprinkle, Plater, 850, Marion, Indiana.

GET profitable, unseen, unbelievable thrilling novelties. Unavailable elsewhere. Samples 50c. Motiwala, Third Bhoiwada, 38U Bombay 2.

400% PROFIT—The Perennio Calendar 640 years. Vest pocket size, 24 pages. $5.75 hundred. Sample 10c. Box 388, Baltimore, Md.

MEXICAN Novelties! 100%-300% profit! Free particulars. Samples 10c stamps. Marquez-MA, Apartado 1176, Mexico City.

ATLAS Window Sign letters. Large Sizes, Penny Each. Beautiful Free Samples. Atlas, 7941-G Halsted, Chicago.

300% PROFIT Selling Gold Leaf Letters for Store Windows; Free Samples. Metallic Co., 448 North Clark, Chicago.

AFTERNOONS Free! $340 mo.—home! No canvassing. Expect surprise! Folio-S, Sta. D, Los Angeles.

SENSATIONAL New Sellers, Free catalogue, samples. Paty Company, Somerville, Mass.

AMERICAN POLICE JIU JITSU

36 KNOCKOUT Blows without use of fists, by internationally famous Jiu Jitsu instructor. Send 25c. S. J. Jorgensen, 297 Maritime Bldg., Seattle, Wash.

ARC WELDER

75-200 AMPERE arc welder from Dodge generator. Complete plans and valuable catalog 35c. 100 other generator changes. LeJay Manufacturing, 314 LeJay Bldg., Minneapolis, Minn.

AUTOMOBILES

"SEMI-DIESEL." Get in the money. City and country agents wanted. Write now. Economy! Performance! Mileage! Semi-diesel conversions for gasoline motors. Manufacturers written guarantee. Learn basic facts from free literature. Houston & Logan Conversions, 2021 Grove St., Berkeley, Calif.

PRINCIPLES of Semi-Diesel. A complete course $1.50. Build your own conversion! Semi-Diesel Research Publications, Santa Monica, Calif.

SAVE Gas, Oil. Installation under 50c. Particulars stamp. Community Research, Box 323, Farrell, Penna.

AUTO SUPPLIES & EQUIPMENT

CONVERT your car to burn Diesel oil. Save up to 70% fuel costs. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular No. 5A. Harrington Company, 201-204 Manchester Building, Portland, Oregon.

AUTO TRAILER

DRAWINGS and instructions for building 6 different house trailers 50c. Instructions and drawings for electric outboard and propeller 25c. Economy Trailer Company, Sedan, Kansas.

AVIATION

GET Into Aviation. Air Transport pilots get up to $6,000 per year, mechanics $2,500. Learn at this Government Approved School. Write for complete information. State age. Lincoln Flying School, 4002 Aircraft Building, Lincoln, Nebraska.

AVIATION Apprentices. Good Pay—Big Future. Write, immediately, enclosing stamp. Mechanix Universal Aviation Service, Strathmoor Station, Dept. A2, Detroit, Michigan.

PROPELLERS—quality, lowest prices, Aeroplanes, sleds, fans, windchargers, free catalogue. Standard Propellers, Fort Worth, Texas.

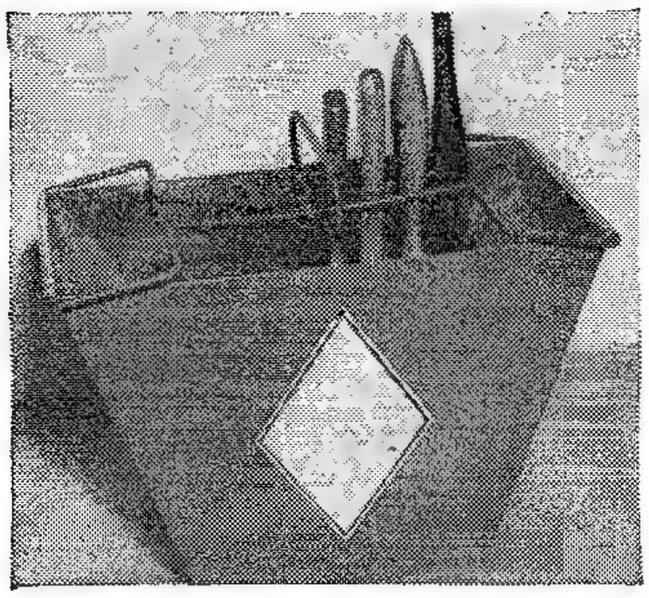
BICYCLES

REPAIR, Rebuild bicycles, full details $1.00. Sites Bike Shop—Broadway, Ft. Wayne, Ind.

BLUEPRINTS

METAL TUBE Midget Radio, the last word in compact radio receivers. You can construct this set even though your knowledge of radio is limited by following the large pictorial blueprints available, from Fawcett Publications, Inc., Greenwich, Conn., at 50c postpaid.

Special Holder For Brushes



An arrangement of wires over the top of this special paint brush container holds them so that the bristles extend into a solvent solution to prevent them from hardening. Having space for eight brushes, three to four quarts of solvent are required.

BOATS

BUILD Your Own Boat! 144-Page book gives complete plans and instructions for easy-to-build boats, from 7 to 27 feet. Send 50 cents in stamps, money order or check to Fawcett Publications, Dept. C-1, Greenwich, Conn., for your copy of HOW TO BUILD 20 BOATS.

FORD and Lincoln Marine Conversions. Send 10c for information. Lehman Engine Co., Newark, N. J.

SAIL your canoe, rowboat! Complete rig $12 to $19. Try-Sail Company, Patterson, New York.

BOOKS & PERIODICALS

SPORTSMEN'S MANUAL—The outdoors man's guide containing scores of practical articles by America's leading outdoor writers, covering every phase of fishing, hunting, camping, and trapping. This book, edited by Robert Page Lincoln, will make that next vacation a dozen times more enjoyable. Price 50c at your newsstand, or order directly from Fawcett Publications, Inc., Fawcett Bldg., Greenwich, Conn.

BUSINESS OPPORTUNITIES

FASCINATING business. Repair, adjust typewriters, adding machines. Learn easily at home from factory expert. Earn up to $15.00 daily. Complete instructions covering all makes $3.00 postpaid or sent C.O.D. Adding Machine Equipment Service, 3601 Michigan, Dept. 204C, Chicago.

WE START you in business, furnishing Outfits and Instructions, operating "Specialty Candy Factory" home. Men and women, earn $25.00 up to $60.00 weekly, all or spare time. (Our 29th year.) Booklet Free. W. Hillyer Ragsdale, Inc., Drawer 110, East Orange, N. J.

MAN in Each Town to Plate Auto Parts, Reflectors, Bicycles, Fixtures, Mirrors, by late method. Simple plan of manufacturing at home starts You in Good Paying Business. Free particulars and proofs. Gunmetal Co., Ave. A. Decatur, Illinois.

MAKE artificial marble, glazed tiles, uncanny. Tabletops, plaques, floors, hones, novelties. Hard, fireproof, inexpensive, cement secrets. Brilliant tile and liquid rubber samples 3c. John H. Payn, 945 Grande Vista Avenue, Los Angeles, Calif.

COLOR-GLAZED Concrete pottery, tiles, walls. New method. No molds. Use only sand, cement, cheap materials. Money-making business for Men. Colorplate, details Free. National Potteries, 15 West 26th, Minneapolis, Minn.

LIKE To Write? Earn extra cash! Clipping and preparing newspaper articles for publishers. Simple, fascinating, profitable. Stamp brings details. Division 76, National Press, 3923 West Sixth, Los Angeles, California.

COLOR concrete surface with chemical solutions. Beautiful pottery without moulds. Garden wishing-wells. Stucco rock. Glazing concrete. Sample 10c. Hollywood CementCraft, 8528 Wonderland, Hollywood, California.

PROFIT with new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, CE-1142 Sunnyside, Chicago.

MANUFACTURE from Phospholene. Cleaning fluid 1c gallon; bleach 2c gallon; hand soap 2c pound; and ten fast sellers. Sample 25c. Details free. Western, 6614 Denison Ave., Cleveland, O.

IF YOU are looking for a chance to devote your spare or full time to profitable work see our offer on page 141. Metal Cast Products Co., 1696 Boston Road, New York City.

AFTERNOONS free for outdoors, movies. $340 month, home. Unique plan. No canvassing. Prepare for surprise. Folio-S, Station D, Los Angeles.

STOP Experimenting. I'll show you how to make a fortune without capital. I did. You can. Stamp appreciated. Peris, 107-E, East Rochester, N. Y.

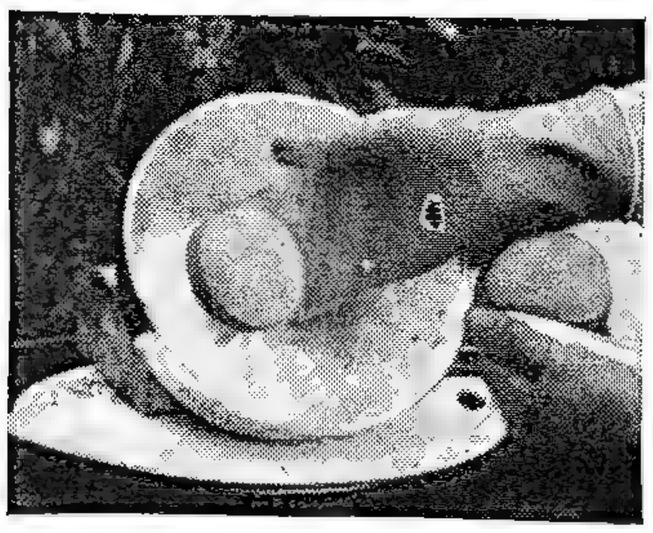
SUCCEED With Your Products. Make-Sell Them. Formulas. Processes. Accurate analyses. Catalog free. A. Thaxly Co., Washington, D. C.

NEWSPAPER — Magazine Clippings Pay. Complete Instructions 25c. Goodall Advertising Agency, 742 Market, San Francisco.

SOAP-MAKING. Learn at home. Complete formulas. No machinery needed. Stamp. Posera, 4545 Bartlett, Milwaukee, Wisconsin.

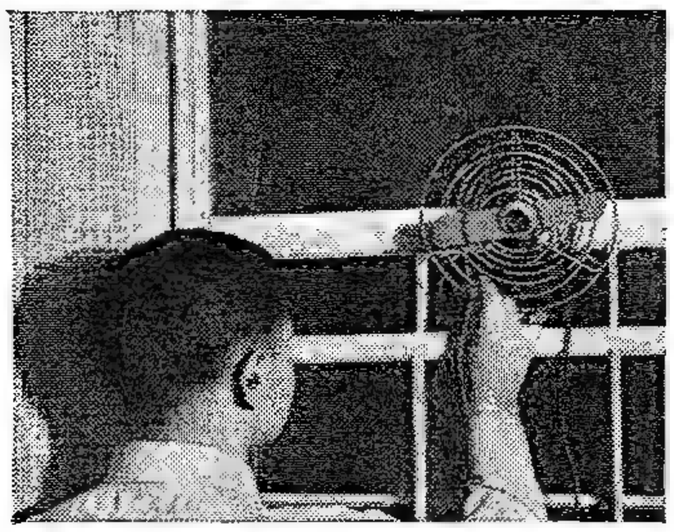
FREE LITERATURE describes hundreds plans for making money locally or by mail. Gilbert Supply, 1107-M Broadway, New York.

Small Pad on Glove Speeds Pan Cleaning



Reinforced with vulcanized pads at the point of greatest wear, a rubber mitten recently marketed protects the hand, while preventing the slipping of dishes. The brush-like quality of the pad makes the cleaning of pots, pans, sink, drainboard and bathtub a simple task without use of metal scouring devices.

Folding Fan Has Many Uses In The Home



This handy folding fan can be used any place in the home from the kitchen to the living room. When hung near an open window, a cooling breeze can be sent into a room, or the air can be forced from the room to outside. Soft rubber feet prevent creeping. Folds compactly so that it can be carried.

YOU'LL Like Resilvering Mirrors, Autoparts, Reflectors, Making Chipped Glass Signs. Write Sprinkle, Plater, 845, Marion, Indiana.

FOR an extremely profitable lifetime business, operate a Collection-Credit Agency. Free folder. Cole Associates, Syracuse, N. Y.

OPERATE profitable "route" four compartment vendors. Small investment. Penny King, 1233F Chouteau, St. Louis.

AGENTS—To mail our literature. Good profits. Home business. M. Maywood, 149 Fifth Ave., New York.

OVER 100 Tested Business Plans. Stamp brings particulars. Acme Plans Service, Dept. C, Box 904, Tulsa, Okla.

SELL by Mail! Books, Novelties! Bargains! Big profits! Particulars Free! H. Elfco, 438 North Wells, Chicago.

$75.00 POSSIBLE weekly installing sanitary equipment. Plans quarter. Engineer, 237 Fifth, Elyria, Ohio.

EARN cash income, copying and duplicating simple cartoons for advertisers. 3-N Service, Argyle, Wisconsin.

YES, Capital now obtainable for every purpose, valuable information free. Star Service, Wapakoneta, Ohio.

EARN while learning store management. Quarter brings trial instructions. Exchange, 237 Fifth, Elyria, O.

START Donut, Potato Chip, Cheesed Corn Business. Profitable. Vanderpool, Springfield, Ohio.

DO YOU want Promotion, Job or Mail Order Business? Holmes, Box 453, Branford, Conn.

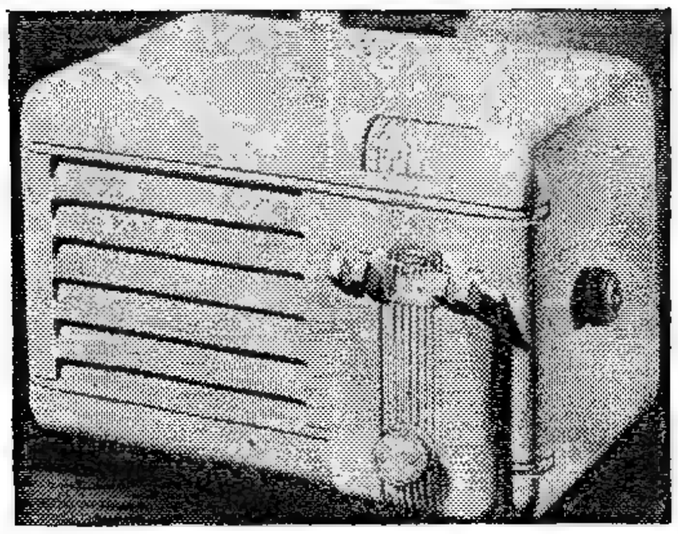
MAKE Sign Letter Patterns. Complete instructions 50c. Harwel, Byrdstown, Tenn.

MIRROR Resilvering and Name Plates. Write. W. H. Kalar, Dresden, Ont.

BUSINESS SERVICE

INFORMATION—Where to Buy Anything! Addresses of any Manufacturers, Wholesalers. 50c (coin). Universal Buyers Service, Lakewood, New York.

Plastic Model Radio Has Push-Button Tuning



A new plastic model radio combines innovations in cabinet design with push-button tuning controls, offering automatic tuning of any of four favorite stations. Each button is geared directly to the tuning condenser, so that initial adjustment can be made easily. Five tubes are used in an advanced circuit.

CAMERAS & PHOTO SUPPLIES

FREE illustrated Photographic Almanac listing everything photographic—still, movie cameras, films, lenses—at tremendous savings. Hundreds of bargains, new and used. All guaranteed. We take your old camera or equipment in trade. Write for free copy of new Photographic Almanac and money-saving bargain book—just out! Limited edition. Hurry! Central Camera Co. (Photographic Headquarters since 1899), 230 South Wabash, Dept. 8-J, Chicago.

AMATEUR Photographers! Learn how to get the most out of your camera and dark room at great saving. Send for PHOTOGRAPHY HANDBOOK, new 144-page complete photo manual for only 50 cents. Send stamps, check, money order to Fawcett Publications, Dept. C-1, Greenwich, Conn.

MAKE money in photography. Learn quickly at home. Spare or full time. Easy plan. Previous experience unnecessary. Common school education sufficient. Interesting booklet and requirements free. American School of Photography, 3601 Michigan Ave., Dept. 2049, Chicago.

INCOME From your camera instead of expense. Low cost home course teaches you to make photographs for magazines, newspapers, advertisers. Tremendous demand. Earn good money wherever you live. Free book. Universal Photographers, Dept. A, 10 West 33rd St., New York.

DUPONT Superior panchromatic, 35mm five foot lengths (tounged), 25' can, $1.30. Optical Development Corp., Larchmont, New York.

CARNIVAL GAMES

AND Merry-Go-Rounds earn Big Money—Outfits supplied. Catalog 10c. "MooreMade," Lapeer, Mich.

CHARTERS

DELAWARE Charters: Complete incorporating and organizing service $35. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Delaware.

CHEMISTRY

CHEMISTRY, Mineralogy, Microscopes, Telescopes, Binoculars. Catalog Free. Tracey Laboratories, Evanston, Illinois.

CORRESPONDENCE COURSES

500,000 USED Technical and business books. Sold, rented, exchanged. All subjects. Satisfaction guaranteed. Cash paid for used books. Complete details and illustrated bargain catalog free. Send name. Nelson Co., 3232 Manhattan Bldg., Chicago.

DETECTIVES

DETECTIVES. Make Secret Investigations. Experience unnecessary. Detective Particulars Free. Write, George Wagner, 2640-V Broadway, N. Y.

EDUCATIONAL & INSTRUCTION

MEN Wanted—Learn Tool & Die Making. Automatic Screw Machine. Machinist Trade. Big Demand. Actual Experience. Expert Supervision. Write for Free Book "M." Allied Screw Machine Co., Inc., School Div., 603-9 Lake St., Chicago.

WORK for "Uncle Sam." $1,260-$2,100 year. Try next announced examinations. List positions and particulars telling how to qualify—Free. Franklin Institute, Dept. W59, Rochester, N. Y.

ELECTRIC FENCING

FENCE Controller easily converted from Ford T coil. No further costs. Complete plans 35c. LeJay Manufacturing, 814 LeJay Bldg., Minneapolis, Minn.

ELECTRIC PENCIL

ELECTRO-SCRIBE: Electric Pencil Writes—Engraves all Metals. $1.00 postpaid. Details Free. Beyer Mfg. Co., 4515-Y Cottage Grove, Chicago.

ENGINES, MOTORS, ETC.

WINDING Data, 225 motors, single and three phase. Price $1.00. Motor Data Service, Box 7631, Kansas City, Mo.

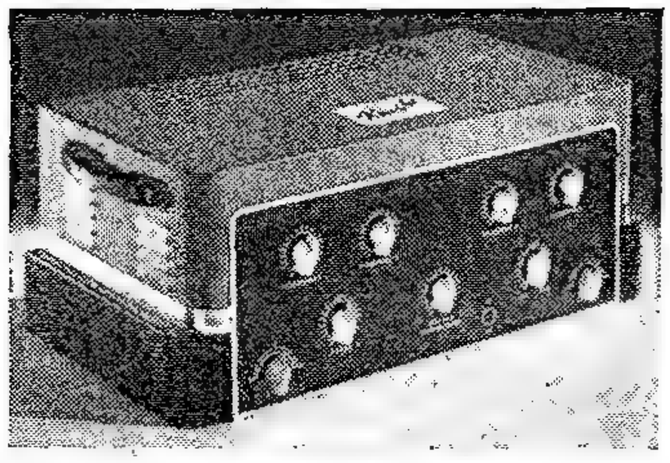
FOR INVENTORS

PATENT Your Idea. Write immediately for two free books, "Patent Protection" and "When and How to Sell an Invention." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send "Evidence of Invention" form. Prompt service, reasonable fees, thirty-nine years' experience. Avoid risk of delay. Address: Victor J. Evans & Co., Registered Patent Attorneys, 42-J Victor Building, Washington, D. C.

Electroplating Outfit Uses Portable Brush

This portable electroplating outfit makes it possible to electroplate objects without subjecting them to the usual plating tank. Objects fastened down can be replated without being removed. The unit uses a brush as an anode, which spreads the plastic plating solution.

Public Address Unit Has Varied Uses



This sixty-watt amplifier can be used with four or less separate microphones, and also one or two radio or phonograph reproducing inputs. By means of the individual contacts conveniently spaced on the front panel, the various inputs can be mixed and blended in any desired proportion; speeches and announcements can be superimposed on a musical background.

INVENTORS—Time counts—Don't risk delay in patenting your invention. Write for new 48-Page Free booklet, "Patent Guide for the Inventor." No charge for preliminary information. Clarence A. O'Brien and Hyman Berman, Registered Patent Attorneys, 28-B Adams Building, Washington, D. C.

INVENTORS: Send for my free 72-page book. Conscientious, prompt personal service on all patent matters. Registered Patent Attorney, L. F. Randolph, Dept. 341, Washington, D. C.

BUYERS located meritorious patented, unpatented inventions. Descriptive booklet, disclosure form free. If will sell, write us immediately. Invention Reporter, T-11236 South Fairfield, Chicago.

WE SUCCESSFULLY sell inventions, patented and unpatented. Write for proof, and tell us what you have for sale. Chartered Institute of American Inventors, Dept. 5-B, Washington, D. C.

"1,300 PATENTED Drawings With How To Obtain Patents, Trade-marks and Copyrights" $1 Postpaid. Free Particulars, 75 Drawings. Instructor, 25 South Pearl, Youngstown, Ohio.

GET Your Own Patents. Legal blanks, complete instructions $1. Cudding Sons, Campbell, California.

FORMULAS, PLANS, ETC.

SOILLESS Culture. Raise flowers and vegetables in cheap chemical solution. Grow faster and larger. Formulas 50c. Chem-Plant, 2821 N. California, Chicago, Ill.

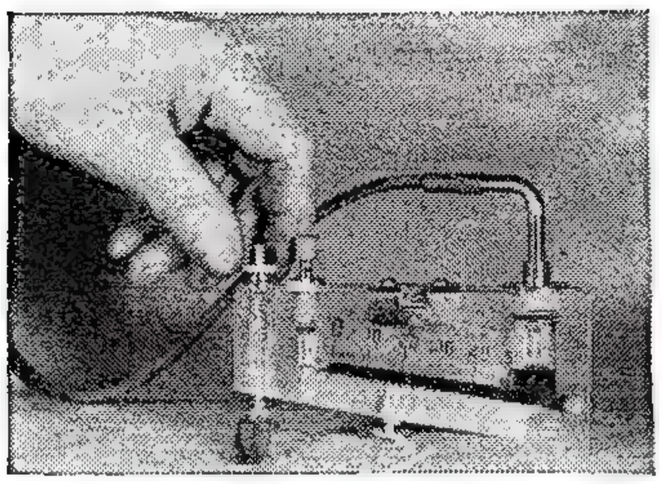
ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemists, CE-1142 Sunnyside, Chicago.

SUCCEED With Your Products. Make-Sell Them. Formulas. Processes. Accurate analyses. Catalog free. A. Thaxly Co., Washington, D. C.

FORMULAS. Latest Money Makers. Literature free. D-Belfort, 4042 N. Keeler, Chicago.

FORMULAS—All kinds. Guaranteed. Catalog Free. Kemico, 67, Parkridge, Illinois.

Gauge Measures Draft in Room



Designed for air conditioning and heating engineers, this handy device measures the amount of draft in a room. The scale is read in hundredths of an inch. It is made of plastic material, with the exception of the leveling bubble which is of glass.

GAS LIGHTER

NEW Perfected Automatic Gas Lighter for 25c. The Purble Cross Co., Lake Village, Ark.

HOME CRAFTSMAN

BIG PROFITS—Make, sell unique lawn ornaments, book ends, door stops in spare time. 20 patterns, designed by real artist, full instructions $1.00 postpaid. Wickman, Dept. 48-C, 744 Brooklyn Ave., Dayton, Ohio.

HYPNOTISM

HYPNOTISM. Complete 20 Method Course 25c. Western Institute Hypnotism, MM-2984 North Ridgeway, Chicago.

INVENTIONS

INVENTORS: Sell your unpatented invention with positive safeguards under patent laws. New low-cost procedure. Complete details, free. American Patents Corporation, Dept. 5-E, Washington, D. C.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Co., 582 Enright, St. Louis, Mo.

IF YOU have a practical invention for sale, write National Service Bureau, Dept. M-1, St. Louis, Mo.

INVENTIONS WANTED

SMALL inventions wanted by manufacturers. I'll help you sell your invention. Write for free circular. S. Hull, 7829-L Euclid Avenue, Cleveland, Ohio.

MACHINERY, TOOLS & SUPPLIES

USED power tools, workshop equipment—direct owner prices. Buy or sell thru our service. Latest lists, 20c. Toolisting, Box 581-B, Zanesville, Ohio.

MAGIC TRICKS & NOVELTIES

FREE! Magic Catalog 500 tricks. Amaze. Mystify friends. Write today! Lyle Douglas, Station A-3, Dallas, Texas.

WE SUPPLY every noted magician. Large Professional catalog 25c. Holden, 222 West 42nd St., New York.

MALE & FEMALE HELP WANTED

M. M. EARNED $267, three weeks, raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. We buy crops. Book free. United, 3848 Lincoln Ave., Dept. 85, Chicago.

MALE HELP WANTED

LOCAL agents wanted to wear and demonstrate suits to friends. No canvassers. Up to $12 in a day easy. Experience unnecessary. Valuable demonstrating equipment, actual samples Free. H. J. Graves, 1300 Harrison, Dept. H-819, Chicago.

MIDGET AUTOMOBILES

BUILD a Midget Miller Racer. Complete plans for constructing this authentic midget automobile appear in the new 1938 edition of How-To-Build-It along with many other interesting home and workshop plans. Send 50c for this 148-page book to Fawcett Publications, Inc., Greenwich, Conn.

MIDGETS! Plans, parts, building kits. New catalog—plan book, 10c. Latest list used motors, midgets, parts (direct owner prices), 20c. Circulars free. Shipps Midgets, Box 543-B, Zanesville, Ohio.

MODEL ENGINES

CATALOGUE of over 40 Engines—Castings—Supplies, 25c. Refunded. Emco, 2417 North Ashland, Chicago.

MODELS & MODEL SUPPLIES

YOUR Ideas developed into practical working model. 30 years successful experience; thousands satisfied customers. Confidential service guaranteed. Bank references. Send 3c postage for 32 page book "Making Inventions Pay." Crescent Tool Company, Dept. T. Cincinnati, Ohio.

MODEL RAILROADING

BUILD a Model Railroad in 00 gauge (¾ inch between rails). A complete catalogue of parts, construction kits, and completed units. One Dime. Nason Railways, P. O. Box 9, Mt. Vernon, N. Y., Dept. 8X.

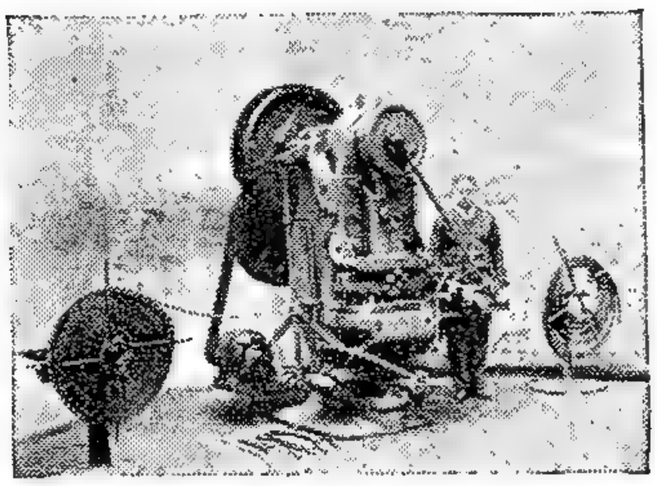
MONEY MAKING OPPORTUNITIES

SELL Colored Folks: Hair Dressing, Bleach Cream, Perfumes, Incense, 300 Products. Write for Free Samples. Big Money Making Offer. Valmor, 2241-S.M. Indiana Ave., Chicago.

MAKE More Money. Our "Self Help Bulletin" will show you the way. Send for your Free Copy Now. Acme Book Shop, Box 93, Battle Creek, Michigan.

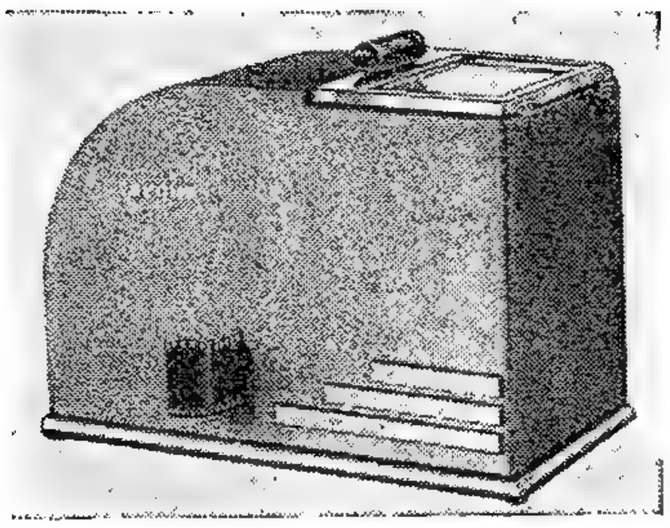
HUNDREDS of money-making opportunities—for anyone—anywhere. Write Technical Service Co., 6-a2 Ashland St., Boston, Mass. Enclose 10c.

New Machine Turns Out Chain at High Speed



Operating practically without human aid, this automatic machine makes a finished chain from raw material at the rate of 40 to 60 links per minute. A continuous ribbon of strip steel is fed in at one side of the big press, passed through a series of seven progressive dies, and emerges in the form of a completed chain ready for use.

Automatic Speed Printer Enlarges 35 mm. Film



This automatic printer enlarges double-frame size 35 mm. negatives to 2¾ by 4¼ inches. No adjustments or focusing is necessary.

MONEY Making Opportunities, practical and legitimate. Free particulars. Schembri, Box 1271, Desk 14, Detroit, Michigan.

MOTION PICTURE SOUND EQUIPMENT & ACCESSORIES

SLIGHTLY Used 8mm Univex camera $7.70; projector $10.50. Used 100 foot 16mm films $1.00, 400 foot $5.00. Soundfilm 16mm projector, amplifier, speaker, complete, $149.50. Eastman 16mm Camera $14.50. Keystone 16mm Camera $9.85. Mogull camera film 16mm $2.35 with processing. Sound-Silent 8, 16mm film library, sent anywhere. Removal Bargain Lists free. Mogull's, 68-M West 48th Street, (opposite Radio City) New York.

MOTORCYCLES

RECONDITIONED Motorcycles. New—used parts for all makes. Authorized Harley-Davidson Dealer. Whitman Motorcycle & Supply Co., 405-9 Southwest Blvd., Kansas City, Mo.

SEND 15c for illustrated used Motorcycle catalog. Bargains. Largest stock genuine Indian parts and motorcycles. Indian Motorcycle Sales, Kansas City, Mo.

OFFICE EQUIPMENT

TYPEWRITERS, multigraphs, addressing machines, adders, dictaphones, duplicators, sealers, folders. Save half, write Pruitt, 553 Pruitt Bldg., Chicago.

OIL PAINTINGS

OIL painting from photograph (portrait) $5. Sokash, 116 Cedar, Pittston, Penna.

PATENT ATTORNEYS

PATENT Your Idea. Write immediately for two free books, "Patent Protection" and "When and How to Sell an Invention." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send "Evidence of Invention" form. Prompt service, reasonable fees, thirty-nine years' experience. Avoid risk of delay. Address: Victor J. Evans & Co., Registered Patent Attorneys, 41-J Victor Building, Washington, D. C.

INVENTORS—Time counts—Don't risk delay in patenting your invention. Write for new 48-Page Free booklet, "Patent Guide for the Inventor." No charge for preliminary information. Clarence A. O'Brien and Hyman Berman, Registered Patent Attorneys, 28-B Adams Building, Washington, D. C.

UNPATENTED Ideas can be sold. I tell you how and help you make the sale. Particulars, with list of manufacturers and wanted inventions, sent free on request. Write Wilson Holmes, 905 Barrister Bldg., Washington, D. C.

"INVENTOR'S Guidebook" containing 96 mechanical movements and advice about patenting, selling inventions, also "Record of Invention", Free. Frank A. Ledermann, Patent Attorney-Engineer, 154 Nassau Street, New York.

HAVE YOU a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 5-A, Washington, D. C.

REGISTERED Patent Attorney former Patent Office Examiner secures patents for inventors. Write S. Goldstein, 275 East Gunhill Road, N. Y. C.

PATENTS. Booklet free. Highest references. Best results. Reasonable fees. Watson E. Coleman, Victor Building, Washington, D. C.

PATENTS

INVENTORS—Time counts—Don't risk delay in patenting your invention. Write for new 48-Page Free booklet, "Patent Guide for the Inventor." No charge for preliminary information. Clarence A. O'Brien and Hyman Berman, Registered Patent Attorneys, 28-B Adams Building, Washington, D. C.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Co., 582 Enright, St. Louis, Mo.

PHOTO DEVELOPING

TAKE Your Pick! One Master Natural Color Enlargement, two beautiful enlargements, or 8 duplicate prints Given Free with Roll Developed and 8 high-gloss prints for only 25c coin. Reprints 3c each. Overnight service. Amazing professional quality must delight you or money back! Sixteen years experience. Sunset Service, 271 Sunset Building, St. Paul, Minnesota.

THE PHOTO MILL. Immediate Service! No Delay! Roll developed, carefully printed and choice of two beautiful 5 x 7 double weight professional enlargements, one tinted enlargement, or eight reprints for 25c coin. Reprints 2c each. The Photo Mill, Box 629-91, Minneapolis, Minn.

FINER Finishing. Rolls developed and printed, with One Colored enlargement, or two professional enlargements. All for 25c (coin). Genuine, Nationally Known, Moentone Superior Quality. Moen Photo Service, La Crosse, Wis.

SNAPSHOT Folder with every roll developed, 8 prints, painted enlargement —25c. Reprints 3c. Fast service. Janesville Film, A-39, Janesville, Wisconsin.

SNAPSHOTS in Colors—Roll developed, 8 Natural Color Prints—25c. Natural Color reprints—3c. Amazingly Beautiful. Natural Color Photo, C-39, Janesville, Wisconsin.

IDEAL Photos. 25c per roll, finished with round corner prints. Coupon and snapshot folder free with initial order. Ideal Photos, Box 2255, Paterson, N. J.

ROLLS DEVELOPED—25c coin. Two 5x7 Double Weight Professional Enlargements, 8 gloss prints. Club Photo Service, LaCrosse, Wis.

BEAUTIFUL Oil Colored Enlargement in deluxe frame with each roll developed. 25c coin. Badger Studios, LaCrosse, Wisconsin.

SAMEDAY Service: Roll developed, 8 glistening prints, 2 enlargements—25c. Midwest Photo, B-39, Janesville, Wisconsin.

Clamp Holds Lawn Mower in Position For Repairs

This new clamp device for lawn mower repairing allows the worker to have free use of both hands, by holding the mower rigid in any position desired. The clamp suspends the mower at three points between the roller and tie-rod, with a snap-hook around the center of the tie-rod. The various positions of the mower can be changed at will without removing it from the clamp.

ROLLS Developed—8 Larjaprints (enlargements) 35c or 8 regular prints 25c. Star Photo, New Britain, Connecticut.

FILMS Developed, 16 prints, 2 enlargements—25c. Truefoto, Dept. 28, Des Moines, Iowa.

PHOTOGRAPHY

TODAY'S Biggest Camera Bargain! Sample copy sensational 108-page new candid camera monthly, Minicam Magazine, sent Free. (Regular newsstand price, 25c.) Beautifully illustrated with prize-winning photographs. Tells how to take better pictures, answers questions on dark room technique, improves "shooting" ability, advises where to sell photographs. Send 5c to cover postage and packing costs. Minicam Magazine, 10 East 12 Street, Cincinnati, Ohio.

PRINTING

125 LETTERHEADS 8½x11 and 125 Envelopes—$1.00 postpaid. Benneville, 907 West Roosevelt, Philadelphia.

500 2½x3 LABELS 90c; 1x2½ 25c. Paramount Press, Atlanta, Mo.

RADIOS

REPAIR your own Radio. Save exorbitant charges. Send 25c with description of trouble. Radio Clinic, 10622 Euclid, Cleveland, Ohio. Diagrams for any make Radio 25c.

SOMETHING New—Two tube all-wave portable. Suitable for hikes and outing trips. Plans 25 cents (coin). Bob's Radio Shack, Lewiston, Idaho.

RADIO & TELEGRAPHY

RADIO BUILDERS' MANUAL—A book of radio set building plans and kinks for the home experimenter. Everything from a crystal set to a powerful 6-tube auto radio is included. Price 50 cents—order directly from Fawcett Publications, Inc., Fawcett Bldg., Greenwich, Conn.

RADIO Engineering, broadcasting, aviation and police radio, Servicing, Marine and Morse Telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, King St., Valparaiso, Ind.

SALESMEN WANTED

SALESMEN Sell Suits on our Easy Credit Plan. Free Suits and Pants given as bonus besides large cash profits, premiums and gifts. Sell only (5) suits to get a Free Suit. No limit to number of Free garments you may earn. Wholesale prices $17.95 and up. Sample line Free. No experience needed to make easy sales. All garments individually cut and tailored to measure. Satisfaction or money back guarantee. Three Star Clothes, Inc., 330 South Franklin St., Dept. CV1, Chicago, Ill.

ATLAS Window Sign letters. Large Sizes, Penny Each. Beautiful Free Samples. Atlas, 7149-G Halsted, Chicago.

SPECTROSCOPES

SOLAR Spectroscope $1. Chemical and ore spectroscope $2.50. Spectrometer $5. Cudding Sons, Campbell, California.

TATTOOING SUPPLIES

TATTOOING Outfits, Supplies, Remover, Bargain List. Waters, M-965 Putna, Detroit.

TELESCOPES, MICROSCOPES, ETC.

TELESCOPES, Microscopes, Binoculars; 1938 bargain catalog free. Brownscope Company, 5 West 27th Street, New York.

BUILD reflecting telescope 6" kit $3.50. Instructions 10c, catalog free. Optical Labs, Larchmont, New York.

BUILD an astronomical telescope. Catalogue free. John Pierce, Springfield, Vermont.

VENTRILOQUISM

LEARN Ventriloquism by mail; small cost, 3c stamp brings particulars. Geo. W. Smith, 125 North Jefferson, Room S720, Peoria, Ill.

VIOLET RAY LAMP

ULTRA Violet-Infra Red. Dula Ray Health Lamp. Two separate units in one. Promotes Sun Tan—Vitamin "D." Automatic control. AC-DC current. $3.90 postpaid. Details Free. Beyer Mfg. Co., 4515-M Cottage Grove, Chicago.

WELDING

D.C. ARC-WELDER 25-200 amperes built from North-East (Dodge) automobile generators. Guaranteed Plans $1.00. (Money Back if not satisfied.) Welders Club of America, BB-3432, M-Mart, Chicago. Airmail or C.O.D. 12c extra. Special: Earn money, spare time, selling plans. Write for details. Agents desired.

D.C. ARC-WELDER 25-600 amperes. Build it yourself, use D.C. motors from battery driven electric trucks, conveyors, mules, etc. Guaranteed Plans $1.00. Welders Club of America, BB-3432, M-Mart, Chicago. Special: Agents desired.

Seals—Ancestors Of Today's Postage Stamps

We are so accustomed to the postage stamp that we do not realize its ancestry. The first postage stamp—an adhesive label, that is, used by a nation—appeared in 1840; but there were stamps prior to this, in Greece (1838-39), Sardinia (1818), and revenue stamps long before any of these postal papers.

But the postage stamp has an ancestry which goes further back than the eighteenth century; in fact, it goes back to the beginnings of history. For the ancestors of our stamps were nothing more than seals!

Seals were used for various purposes. They were used by an ancient ruler as his signature; they were used in medieval times to mark and identify documents: and seals likewise were employed, in either or both ways, to seal, or fasten, epistles that were meant for delivery to someone else. The fanciful designs of some modern seals resulted from the fact that seals often were copied or counterfeited—a practice that was not new with the birth of the postage stamp. It was next to impossible to reproduce accurately in the old days, some of these intricately-worked seals.

Sometimes, too, a seal-stamp was not all in one piece, but divided into sections, and various responsible officers had the care of the sections. Thus, if a seal was cut into four parts, each of four men attended to one of the parts. And only with the personal permission of the owner, could those four be brought together, and used to seal a document.

Seals are known to have been used by royalty in ancient Babylon, Egypt, and other sections, and have been employed right down to modern times for similar purposes. In medieval times the seal reached the height of its popularity, and there are so many of them that the novice would be confused by their multiplicity. The British Museum has over twenty-five thousand alone.

The ancient seals were simple or crude, or both; medieval seals grew more and more ornate. The seals of the French Carlovingians and Merovingian monarchs, for example, were fanciful, with mottoes, and portraits. These portrait seals are interesting; approximating the postage stamps bearing portraits, today. The seal of Charlemagne, great emperor of the Franks who laid the foundations of France and Germany, bore the portrait of Jupiter Serapis. The seal of William the Conqueror, Norman duke who made himself dictatorial king of England after 1066, bore on the one side a king upon his throne; upon the other the ruler on horseback and armed with spear and shield.

England's Edward III added miniature saintly statuettes to his seal on the obverse side.

Seals identified nobility as well as royalty, hospitals, the admirality, and other positions in medieval times. As one can tell, today, upon receipt of a letter, from what country it comes, so in earlier days, an epistle was distinguished by its seal. If a baron sent a message, he sealed it with his own insignia; and the recipient was able to identify the sender by that seal.

ADLETS FOR HOBBYISTS

(See regular classified section for rates and other information.)

STAMPS

SUPER-WONDER Packet offered, containing 60 different stamps from Afghanistan, Transjordania, North Borneo, Manchukuo, Sudan, Guadeloupe, Iraq, Sarawak, French and British Colonies, including natives, beasts, ships, etc. This entire packet for only 5c to approval applicants. Big illustrated lists free. Kent Stamp Company, Box 87-Z (G.P.O.), Brooklyn, N. Y.

FREE Stamp Catalogue:—George VI Issue—Giant forty-page quarterly listing Albums, Supplies, Coronations, Canadians, Colonials, United States and foreign. Illustrations galore! Empire Stamp Co., Dept. MM., Toronto, Canada.

DIAMOND Airpost Commemorative Issue Complete, Proletariat Portraits Complete, Dragon Stamp, with 117 additional, cataloging $3.00, only 10c. Friendly Filatelists, Box 4428M, Philadelphia, Penna.

NEW Rivera nude stamp! World's largest triangle! Congo, Sudan, South Seas, bicolors, pictorials and many others. Only 3c with approvals. Cactus Junior Approvals, Box 1870-D. Tucson, Arizona.

1897 GRANDE Comore, Liberian Bongo Antelope, Turks Caicos, Cayman Islands, genuine Baden, etc. Everything 3c with approvals. Viking, 1-MM Hanson Place, Brooklyn, N. Y.

STAMPS! 100 diff. 3c; 500 diff. 35c; 1,000 diff. 90c! Illustrated Album (4000 spaces) 22c. Approvals sent. Tatham Stamp Co. (D9) Springfield, Mass.

147 MANCHUKUO, Mongolia, Ceylon, Egypt, Siam, Algeria, SanMarino, Cuba, Turkey, Etc., 10c. Lufbery, Middletown, Connecticut.

UNITED STATES—45 Different, Perforation Gauge, Hinges, Bargain Price List—all for 10c. Seidenberg, Baroda. Mich.

FREE!!! Two Coronation Sets. Postage 3c. Roberts, 312T Shearerbldg, Baycity, Michigan.

5 FRENCH Colony Sets 10c Coin. Buy-Mor, Box 33, Flint Station, Fall River, Mass.

COINS

BREAKING my entire collection. Old U. S. Coins, Stamps, Newspapers, Indorsed Checks, many Colonial during Washington, also rare relics of many old Indian Tribes, etc. Inclose dime for bargain catalog. Shontz, 151 East 84 St., Station A, Box 5, New York.

FREE: Foreign Coin, Banknote and Large Illustrated coin catalogue, for 4c postage. Approvals sent. Tatham Coinco, Springfield-9, Mass.

COINS, Beadwork, Indian Relics, Minerals, Books, Curios, Stamps. Catalogue, 5c. Indian Museum, Northbranch, Kansas.

COINS FOR SALE

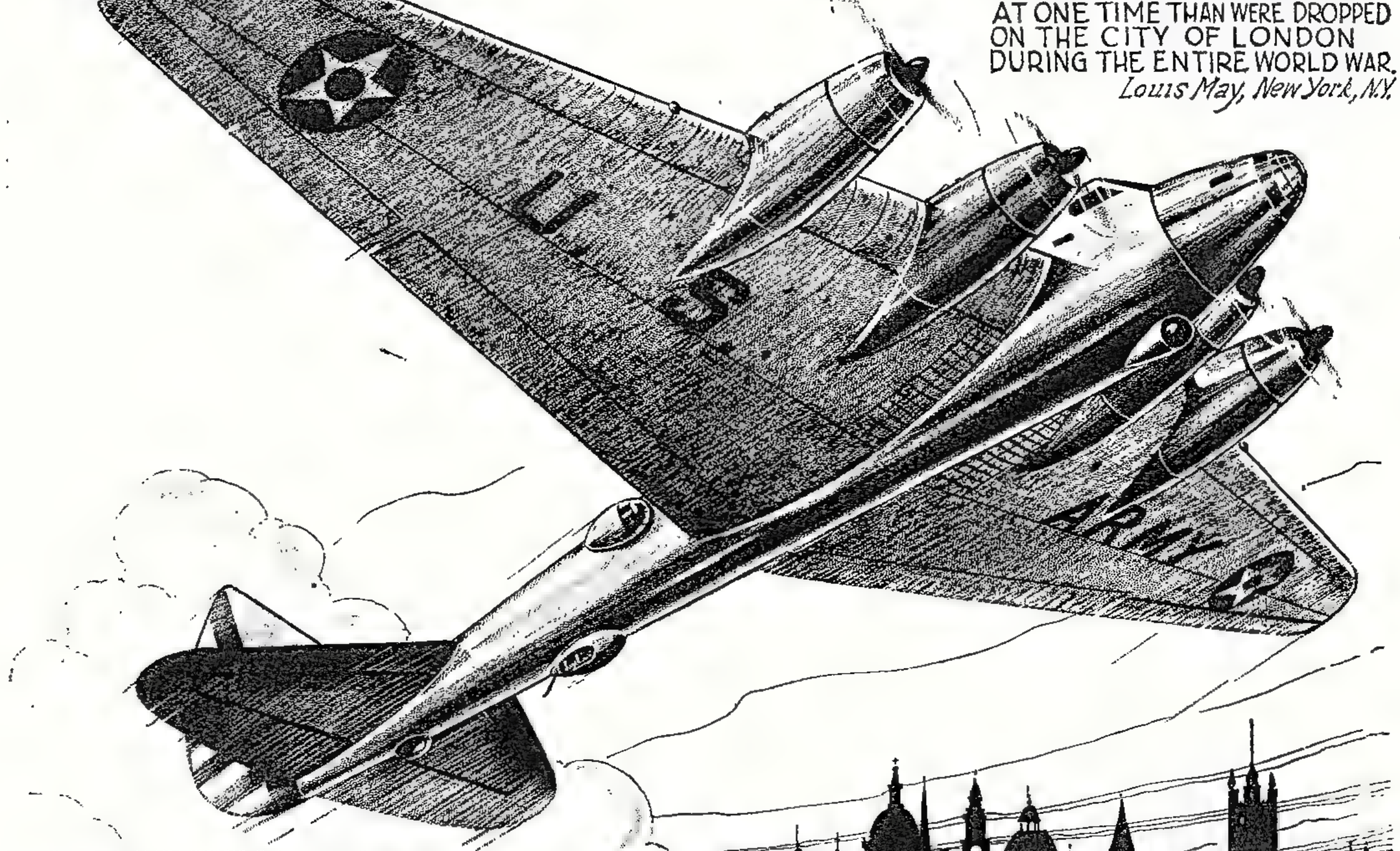
COMMEMORATIVE Half Dollars, Lincoln, Stone Mountain, Oregon, Texas, Cleveland, Kentucky, San Diego, Long Island, $1.50 each. Illustrated Catalogue No. 14, 25c. Norman Shultz, Salt Lake, Utah.

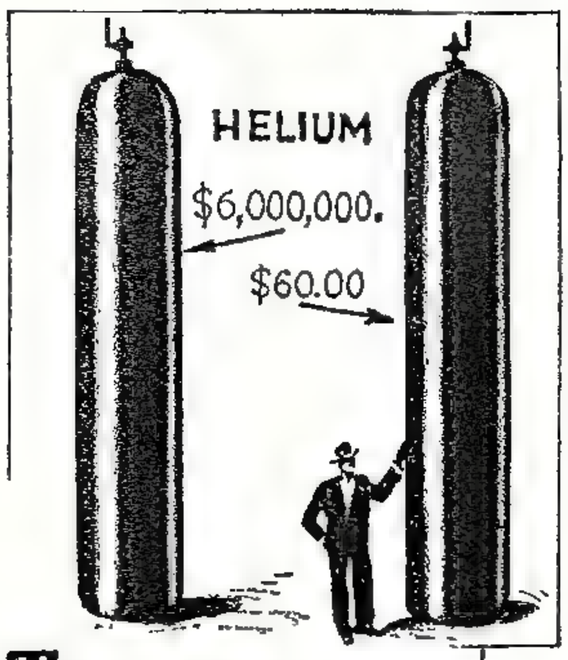
INDIAN CURIOS

INDIAN CURIOS. 100 good ancient Arrowheads $3.00. Tomahawk Head 50c. Illustrated catalog 5c. H. Daniel, Hot Springs, Arkansas.

Flying Fortress Carries Record Bomb Load
Nic Sprank Offers $5.00 For Best Oddity

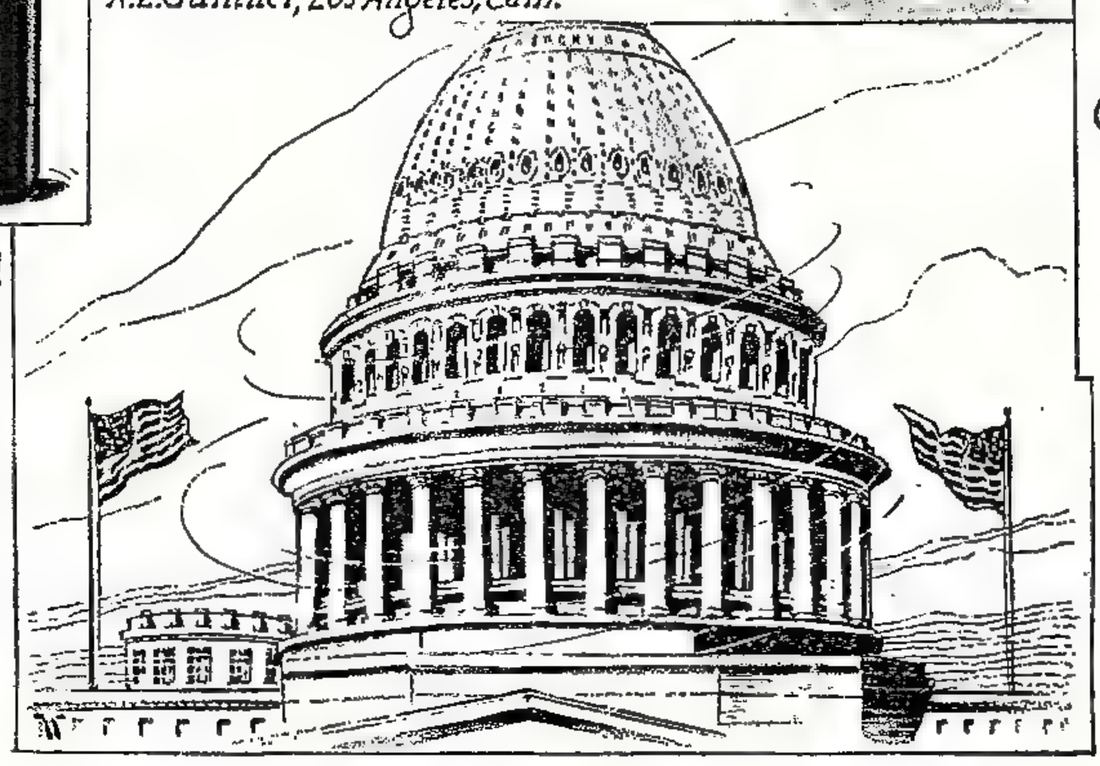
A ONE-PLANE AIR FORCE!— THE U.S. AIR CORPS FLYING FORTRESSES ARE CAPABLE OF CARRYING MORE BOMBS AT ONE TIME THAN WERE DROPPED ON THE CITY OF LONDON DURING THE ENTIRE WORLD WAR.
Louis May, New York, N.Y.

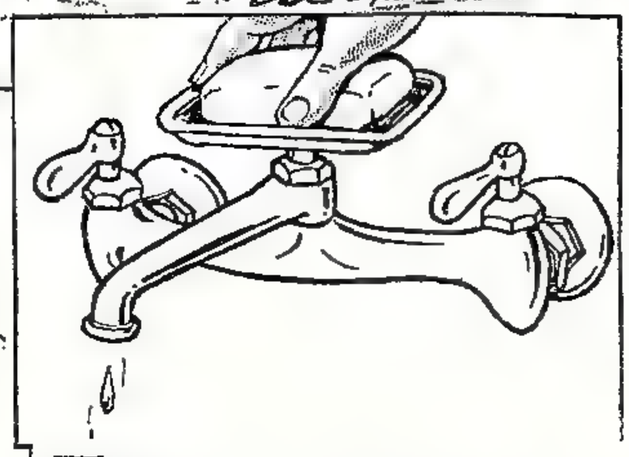




HELIUM PRICE DROPS! THE FIRST SHIPMENT OF HELIUM SOLD BY THE GOVERNMENT TO A PRIVATE FIRM COST LESS THAN $60, ALTHOUGH THE SAME QUANTITY PRIOR TO 1917 WOULD HAVE BEEN VALUED AT $6,000,000.
—*Science Service.*

TWO-DIRECTION WIND! FLAGS ON EACH SIDE OF THE CAPITOL DOME AT WASHINGTON, D.C., SOMETIMES FLY IN OPPOSITE DIRECTIONS BECAUSE OF THE WAY THE WIND WHIRLS AROUND THE DOME.—
R.L. Gunther, Los Angeles, Calif.





WATER WASTERS!— A FAUCET DRIPPING AT THE RATE OF ONE DROP A SECOND WILL WASTE MORE THAN 500 GALLONS IN ONE YEAR.—
Mrs. Delia Smith, Long Beach, Calif.

Five dollars will be paid for the oddity selected by Nic Sprank as the best of the month. One dollar will be paid for all others used on this page. Send your oddity to Nic Sprank, Editorial Office, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y. Source or proof of each oddity must be given. Send all oddities separately, not with other manuscripts or letters.

MECHANIX ILLUSTRATED

Vol. XX
No. 4

August
1938

W. H. FAWCETT
Publisher

Secrets of the Circus Engineers

by F. Beverly Kelley

"KEEP the old rag in the air," is the way they say it sometimes. The "old rag" actually is the Ringling Bros.-Barnum & Bailey big top, largest canvas auditorium extant, and it is new every year. Still it's the "old rag" in circus vernacular and it contains 26,000 yards of water-proof, eight-ounce drill. Its weight is tripled when it is wet. It is 500 feet long and 200 feet wide and it seats nearly 15,000 people.

It is erected within the brief span of three to four hours in approximately 150 cities and towns each season and it is the largest of some

Above: Clowns and pretty girls are a bright highlight on an otherwise furiously busy lot when circus cars arrive (below) and men work feverishly unloading the long flatcars. "Circustown" goes up in 4 hours.

Harness elephants help the engineers solve the muddy-lot problem. They supply the push-pull power.

thirty-odd big and little tents in the canvas community.

Only by the almost perfect functioning of the component parts of a big circus is it possible to move, set up and take down the mechanical marvel that is "the biggest thing on wheels." Circus engineers devote a lifetime to devising easier and simplier methods of handling the big top, and its operation today is an engineering achievement. As a matter of fact, when the Barnum & Bailey circus was in Europe before the World War, it had reached such a point of systematic excellence that the German Army copied its methods of loading and feeding its people.

What were the circus engineering secrets that a world power considered good enough to copy?

To understand this engineering achievement, let us first consider a case in point: It was a stormy night in the Autumn of 1932. The pole wagon was in to the hubs. A forty-horse hitch, snake-hooked to pull from the front and sides, and two elephants pushing from the rear, finally rescued it from the clutches of the sand as the big show fought to get off the lot in Tallahassee, Fla. The next stand on the route was Jacksonville, 175 miles away. The last of the show's heavy wagons got off the lot 10:30 in the morning and headed for Jacksonville, arriving there by rail at 9 o'clock on the night of exhibition. Five thousand people were on the show grounds; cookhouse and stables were up, but nobody expected that a performance would be given. Those spectators reckoned without the circus tradition, however, for the late John Ringling quietly gave the order that wrote another chapter in the history in the nomadic amusement enterprise that builds a new home in a new town every day.

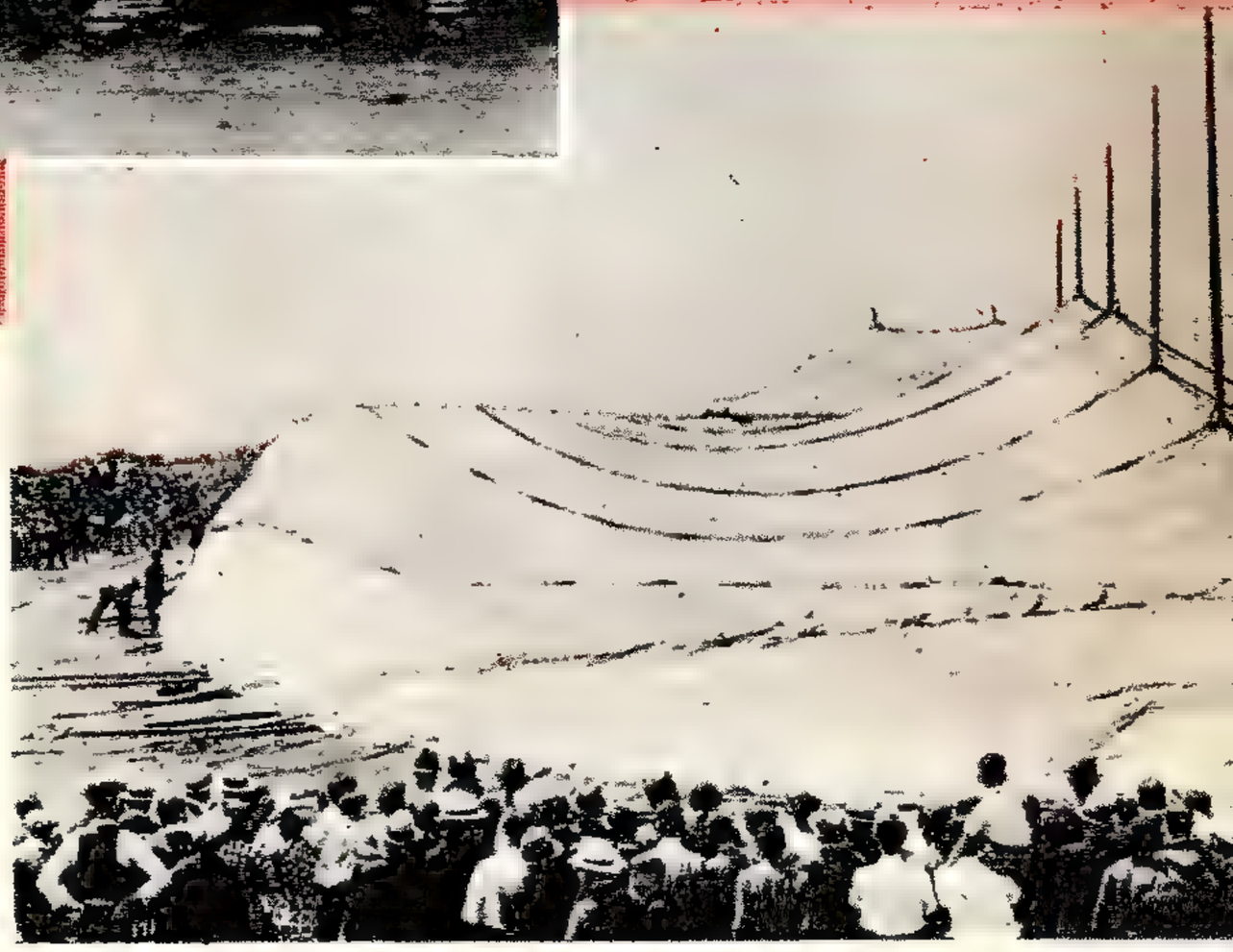
"Put it up. We'll give a show," Ringling said. And put it up they did. The show went on at 12:30 in the morning, exactly three hours after the last section of the circus arrived on the lot.

With the order to "put it up," the circus engineers began to function. "Frenchy" Haley, the layout man, went to work with his pegs, outlining on the ground a complete diagram for the tent positions. Behind him came the pole-men with their towering poles which they erected with the aid of elephants. Canvasman Jimmy Whalen supervised the

Quarter-poles ready for use. They support the tent over the seats and are inspected for flaws regularly.

Quarter-poles go up after the center of the tent has been raised. Then the furniture men move in and have the stands in place by the time the tent is up.

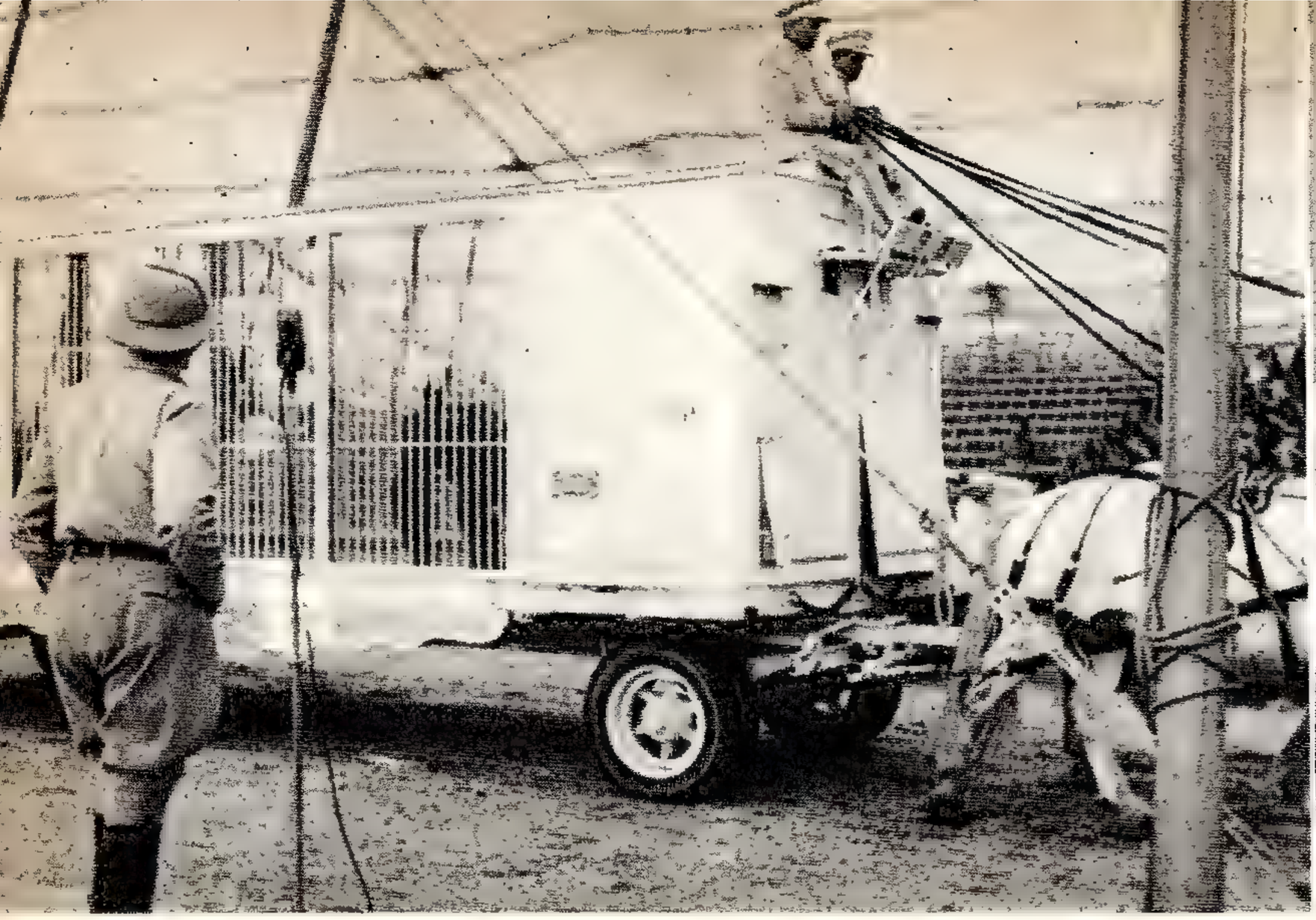
The Big Top is laced together from 18 sections. There are 6⅓ miles of seaming in the top, and it weighs 21,600 pounds.



stretching of the canvas which had to be laid out and laced together. So closely did each engineering job follow the preceding one that all seemed confusion. But when the outside poles were raised and the quarter poles went into position, the tent began to go up. In a little less than four hours, 275 men, aided by baggage horses and harness elephants, had the tent up, the seats in place, and the show was ready to go on.

Several definite milestones in the rocky path of circus history contributed to the fact that it is possible to transport the big show on schedule, erect its billowing big tops under handicaps of rain, mud, wind and sand, present its performances and load out again in a seemingly endles cycle. The show was put on rails in the early seventies. This revolutionized circus business, making it possible to play wide areas on absolute schedule. When Ringling Bros. combined their circus with the Barnum & Bailey show after the World War, they put their enterprise on 100 railroad cars. Obviously it had to move in units. Today, there are four trains comprising the big show's rolling stock, and within the past decade the flat cars which carry the wagons and cages are 12 feet longer than the 60-foot length of the average flat car. The first circus railroad train carries the cookhouse equipment, the stable tents and numerous baggage horses, as well as the wild animal menagerie. This train usually leaves town before the night performance is over and it has its tents in the air in time for breakfast, when the remainder of the show arrives in the next stand. The second section carries the sideshow and the countless props necessary to the presentation of the main circus performance; the third is a veritable "lumber train," transporting the seats, grandstands and attendant equipment, while the last railroad train brings in the performing personnel and also what is termed "lead stock"—

Altogether, the circus engineers put up more than 30 tents. The picture shows a few of the smaller ones.



Circus engineers designed this wagon specially for Gargantua (below). It is glass enclosed and air-conditioned. Interior lights are sunk in the floor. Frank Buck is at the "mike."

animals such as elephants, camels, zebras and performing horses that can be led from the railroad runs to the show grounds. All the sections have sleeping cars for the people who accompany them.

Traveling in four sections would not, however, make possible the engineering triumph of the circus without the supplementary acquisition of various mechanical devices to facilitate the speedy erection of the tented domain. In 1903, when the Barnum & Bailey Circus returned from Europe, bringing with it the European idea that involved the erection of box seats around the hippodrome track, circus engineers went to work with the express purpose of rebuilding the circus along more mobile lines. "Happy Jack" Snellen, who was without any doubt the "Thomas A. Edison" of the big tops, for he more than anyone else was responsible for the mechanical ideas that today immeasurably help to "get it up and keep it up," invented the grandstand to replace the "Bible-back" reserved seats used prior to the practical introduction of individual chairs for circus patrons. He devised the mechanical stake driver that puts down two big wooden stakes at one time after the principle of a pile-driver. He invented the stake puller; the "jokes" on the ends of the seat "stringers" or underframes to hold three more tiers on the grandstand. The critics of this particular development in grandstand perfection looked at Snellen's invention and said "It's a joke," and the name stuck. Similarly, the "funny rope," which he devised to facilitate the quick guying-out of the big tent in the face of a sudden windstorm, somewhat after the principle of the old-fashioned snare drum's leather pulls, got its name when the canvasmen looked and said, "What's dat dere funny rope doin' 'round de big top?"

This circus genius in 1913 put eaves on the tents, an 18-inch lip between the side poles and the outer rim of the tent top, to keep rain from dripping onto the spectators in the top rows of the grandstand. He fashioned a special kind of leather-bound grommets for the quarter-pole holes. Another circus inventor, Bill Curtis, once built a huge "spool wagon" that carried an enormous drum around which canvas could be wound. This was intended to supplant the practice of folding it up in sections and loading it flat. The "spool wagon" had one advantage: it saved labor during the war days when manpower was scarce with the circus, but it later was discarded as impractical because it was hard on the canvas itself and could not function as quickly as a full crew of men assisted by the newest loading invention, the canvas "loader." This device employs the crane principle to lift and load the heavy bundles of canvas after they have been rolled up by the roustabouts. This wagon unloads, too, and its operations save several valuable minutes both in the erection and in the striking of the show.

The big tent is new every year, and the tent of the previous season is carried for any emergency that might arise. This "second" tent is discarded in its third season, when it is replaced by last year's big top, and its hardware salvaged.

Circus center poles are of northern fir, specially shaped and treated. The big top canvas is spread out on the ground in sections like a giant's shirt, assuming, however, an

exact oval pattern, and the 18 sections laced together through 2,088 steel rings. After canvasmen have pushed up the side-wall poles (112 of them) around the outer rim of the big top, a block-and-tackle system handled by men, horses and occasionally by harness elephants hoists the peaks to the center poles which already are in the air and guyed out.

The quarter-poles that support the canvas stretching from center poles to sidewall then are inserted in their grommets and pushed aloft by men and by teams of horses. At this point, the big top is "in the air" and the baggage wagons can move in with their rigging, seats, ringbanks, stages and similar equipment. Putting up the seats and the rigging requires more time than is necessary for the actual erection of the mammoth tent. The rigging such as is used by aerial acts must be put up with extreme care by Mickey Graves and his property men, for the lives of the performers depend on it.

The lot superintendent is Edward Kelley, and it is his job to see that all working departments of the physical show function quickly and properly. The layout crew mark off the lot with tape measure and tiny iron pegs tipped with flags so that the stake drivers will know exactly where to drive their stakes. Then the canvasmen go to work under the supervision of James Whalen, who is seventy-seven years of age and who has been "putting it up and keeping it up" since 1881.

While the principal means of transporting wagons from railroad runs to show grounds and back again involves the use of 300 baggage horses which do not share the spotlight with their performing cousins, the show uses a fleet of motor trucks to haul trailer-fashion some of the lighter wagons and thus to speed up the movement of the show from the runs to the show grounds. The heaviest wagons require four, six and eight-horse hitches. Heaviest wagon on the show is the one that carries the blue quarter-poles. It weighs about 14 tons and nobody with the circus calls it the pole wagon. It's the "smoke wagon" and its nickname has come down through the years from the day when a circus boss shouted to some loafing roustabouts who

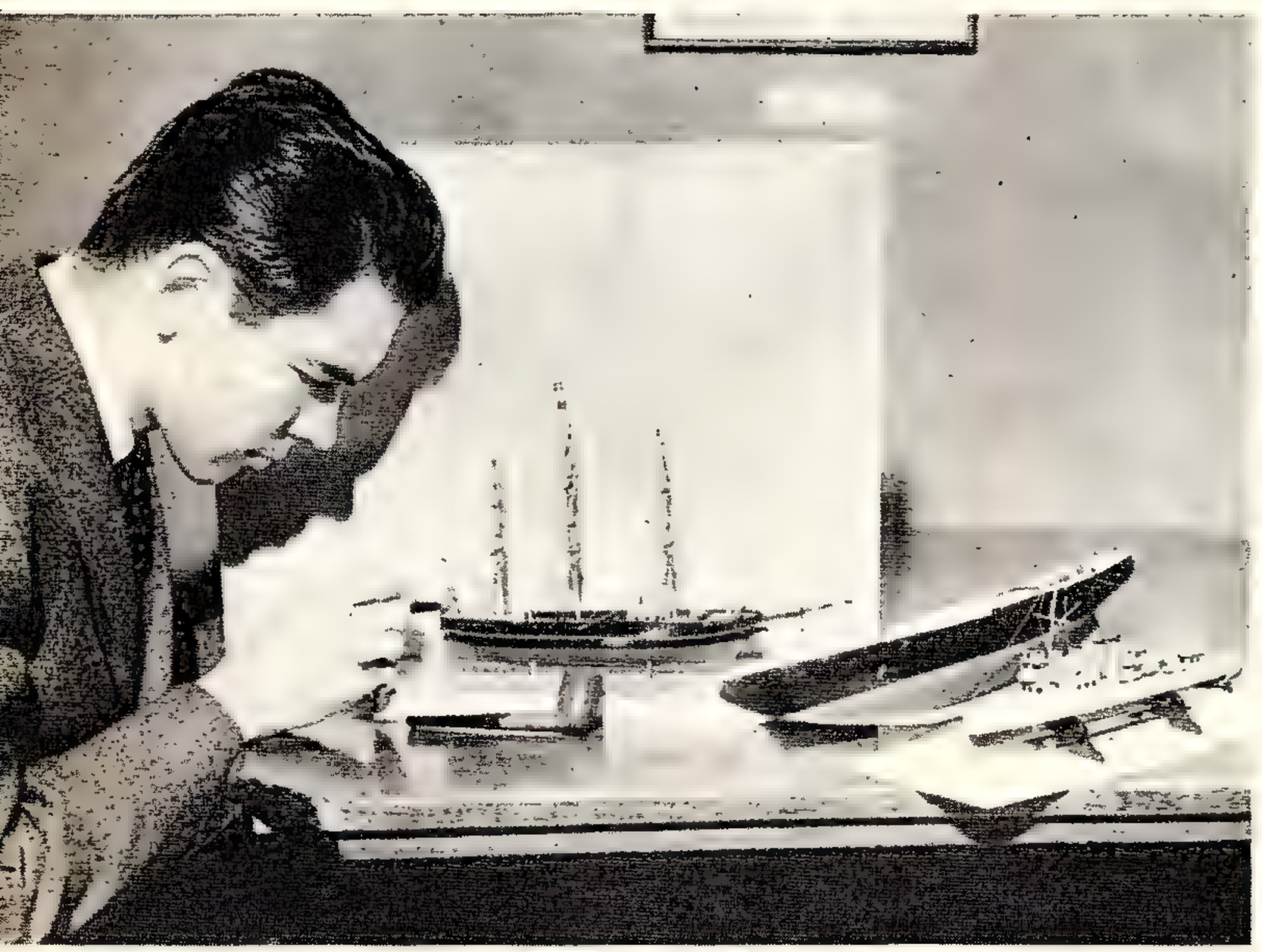
[*Continued on page* 135]

The mighty smithy retains a place of importance in the circus setup. Six portable forges are toted along; repairs are made on the lot.

300 performance horses are used in the circus' stunt repertoire. Clearing this car with a rider standing astride the backs of two horses is just a bowl of cherries for horses and rider.

Reflector Buttons Light Up Michigan Highway

CREATING the first stretch of American highway ever to be illuminated by indirect lighting, new reflector buttons installed on posts (extreme left) along a 70-mile length of U. S. Route 16 between Detroit and Lansing, Mich., reflect the light from passing autos and diffuse it over the highway for about one mile from the point of origin, as shown in photo. The cost of the completed project was about $25,000.

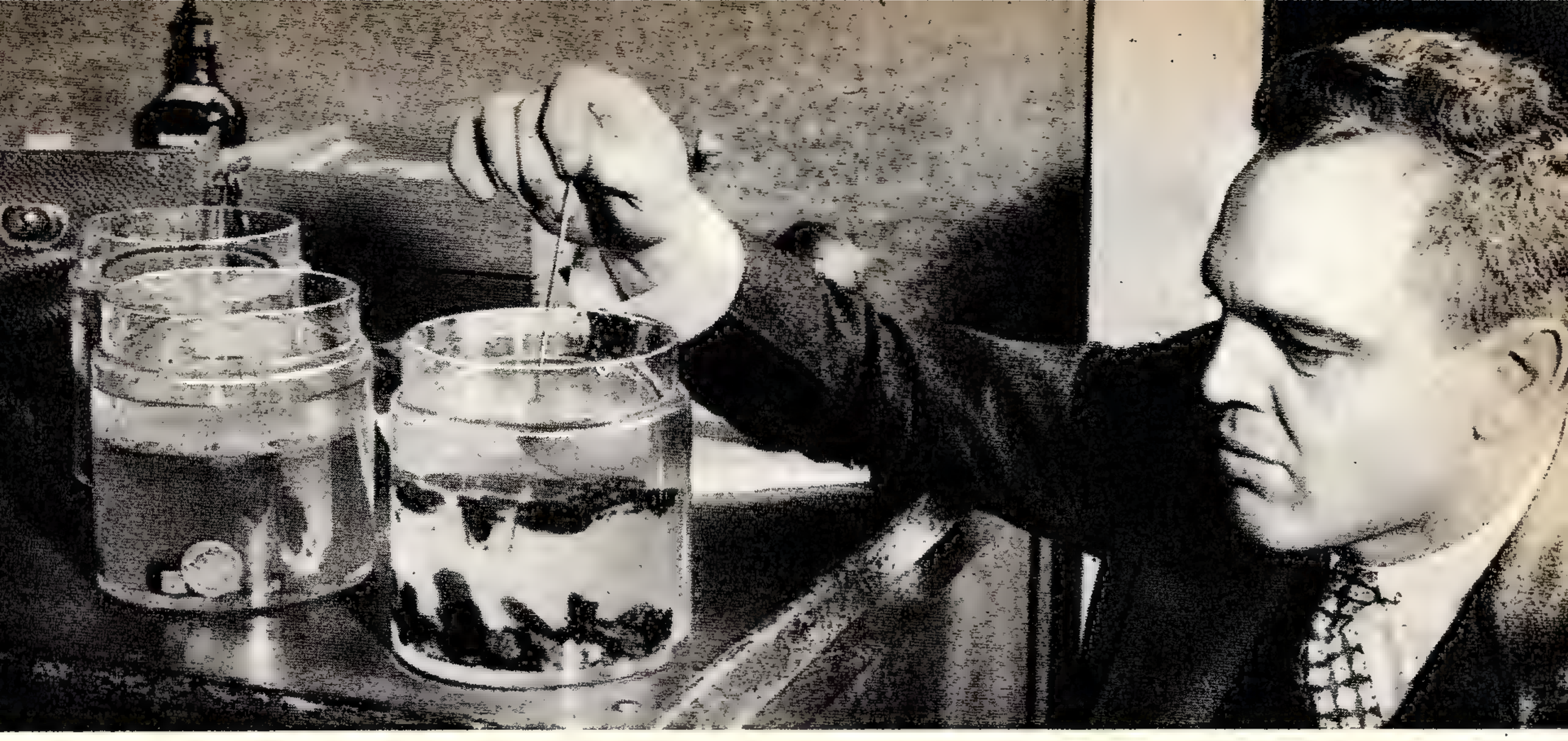


College Students Show Model Handicraft

COLUMBIA University in New York, N. Y., recently staged its fifth annual Hobby Show, displaying models constructed by students. Among the outstanding exhibits, which were shown in the lounge of the university's John Jay Hall, was a three-masted schooner, *Sea Witch,* built by George Freimarck, shown in photo. The other two model boats shown in the photo are a Bluenose schooner hull and the U. S. destroyer, *Preston,* built by William Burling and Albert Hailparn, respectively.

"Soil-Soaker" Device Aids Gardeners

A NOVEL watering device, which screws onto the end of an ordinary garden hose in place of a sprinkler, enables the home gardener to employ the deep-soaking method which Agricultural Colleges and larger nurseries recommend as far more beneficial than surface sprinkling. The device consists of a length of porous canvas tubing through which the water seeps onto the ground.



Chemical Process Improves Coal

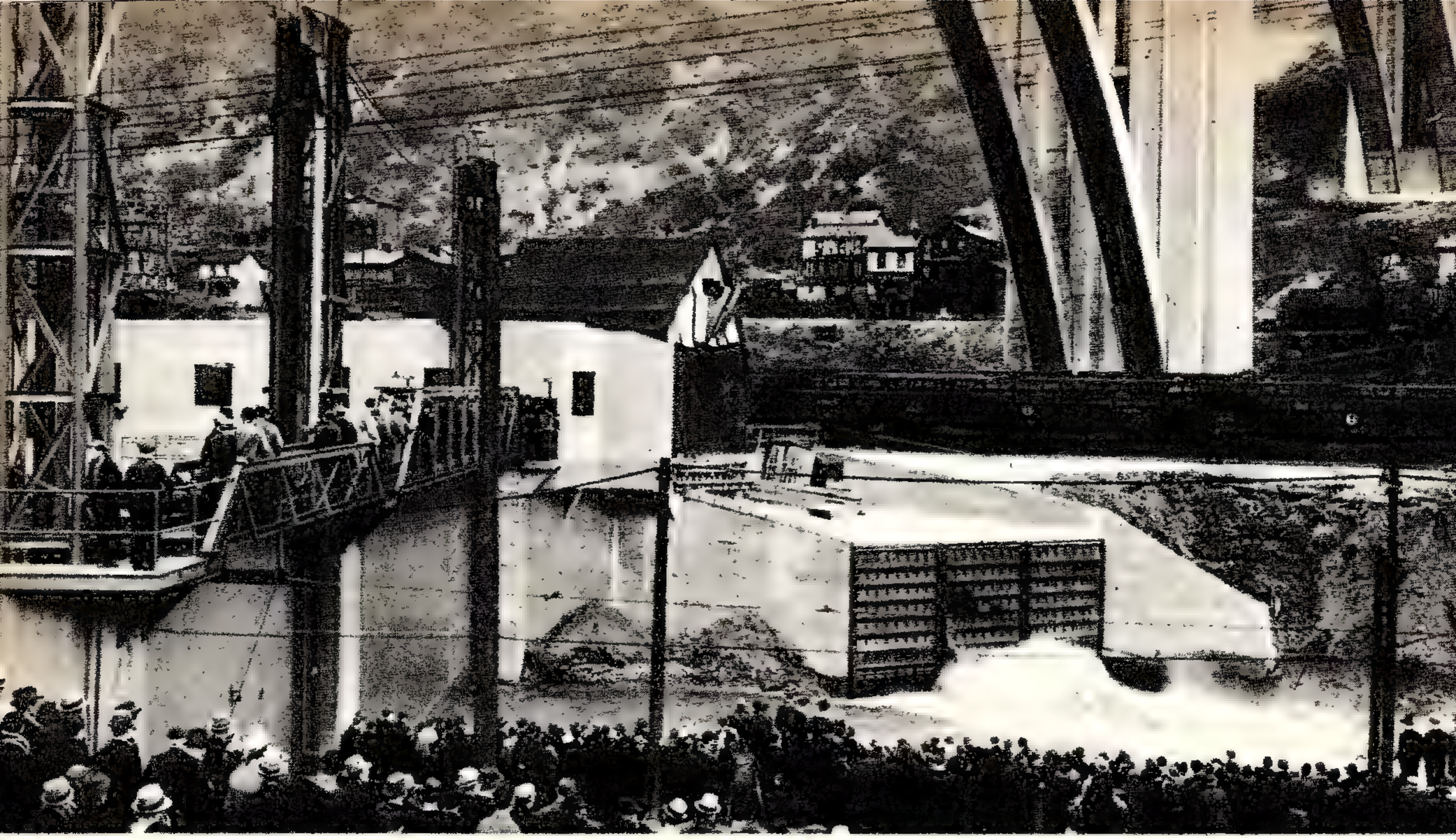
DEVELOPED by a well known chemical firm, a new sink-and-float process enables high-grade coal to be produced from run-of-the-mine grade. The low-grade material is placed in a special fluid and the coal floats to the top while the slate sinks to the bottom, as shown in photo.

Home-Built Bicycle Has "Rumble Seat"

THE latest version of a bicycle built for two has been constructed by A. Bishop, of Richmond, Australia. The novel "rumble seat" bike was constructed by welding together the frame sections of a large and small bicycle.

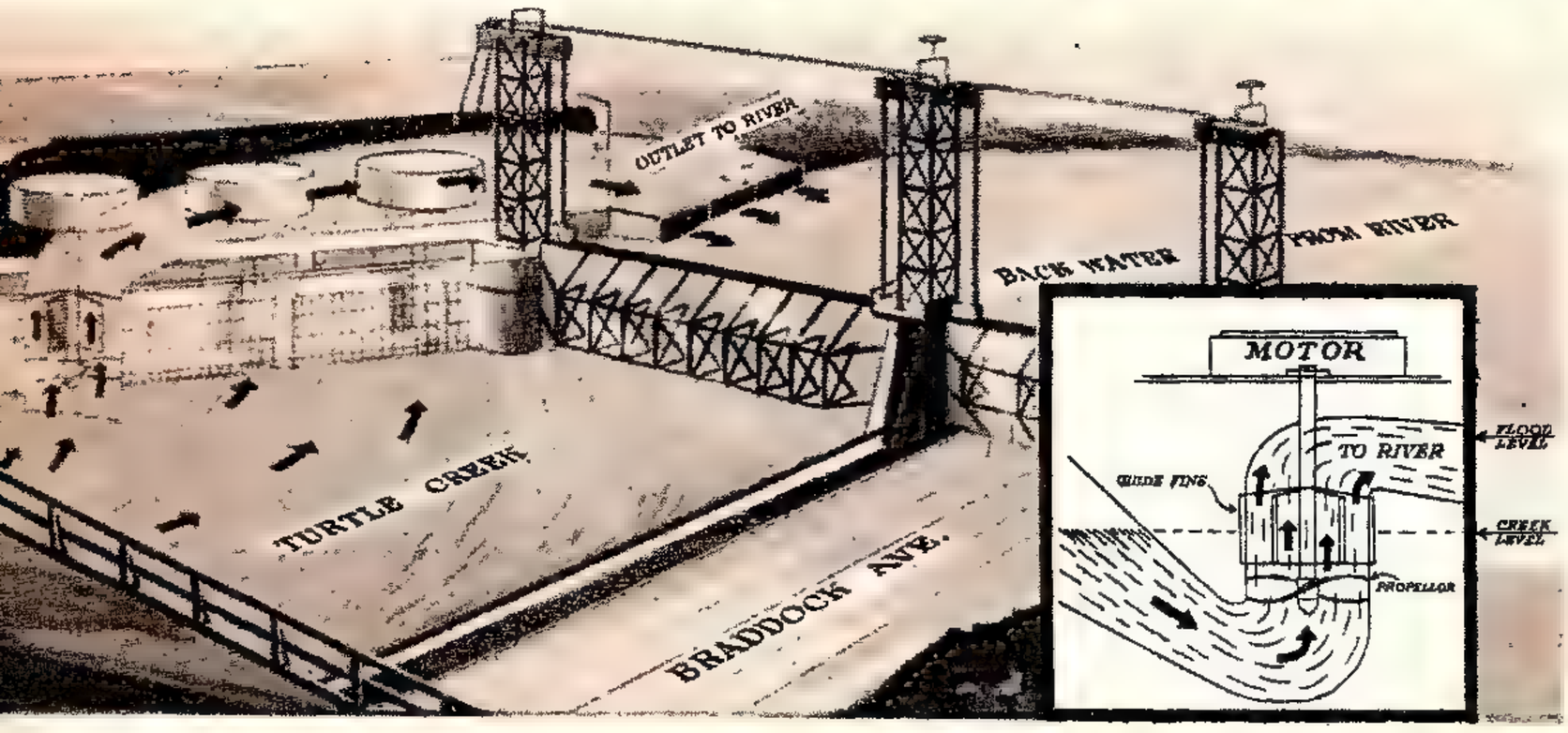
Lightweight Plane Has Folding Wings

FEATURING folding wings so that it can be stored in a garage, a newly developed English single-seater airplane weighs only 400 pounds and can travel 75 miles per hour, using two gallons of gasoline.



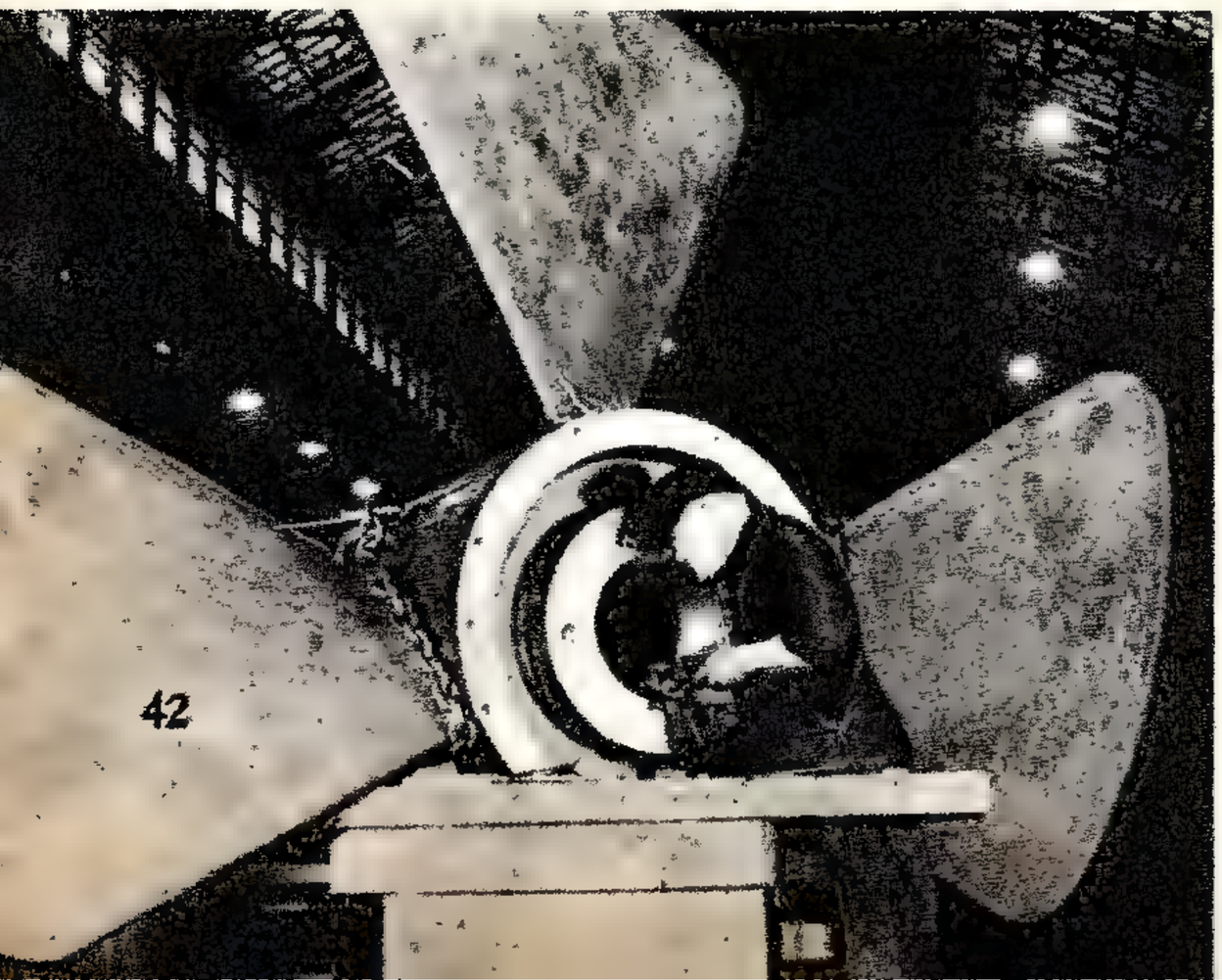
UPSIDE-DOWN DAM CONQUERS FLOODS

In a recent test of the new "upside-down" dam located near Pittsburgh, Pa., two of the three giant vertical pumps demonstrated their ability to force the entire normal flow of Turtle Creek through discharge vents, as shown in the photograph above.



Left—In this artist's sketch of the unusual dam, arrows show the flow of Turtle Creek flood waters through three intake chambers behind lowered steel flood gates. Three 5,000-horsepower electric motors drive 10-ton propellers that force the water upward into discharge vents leading to the Monongahela River (inset sketch).

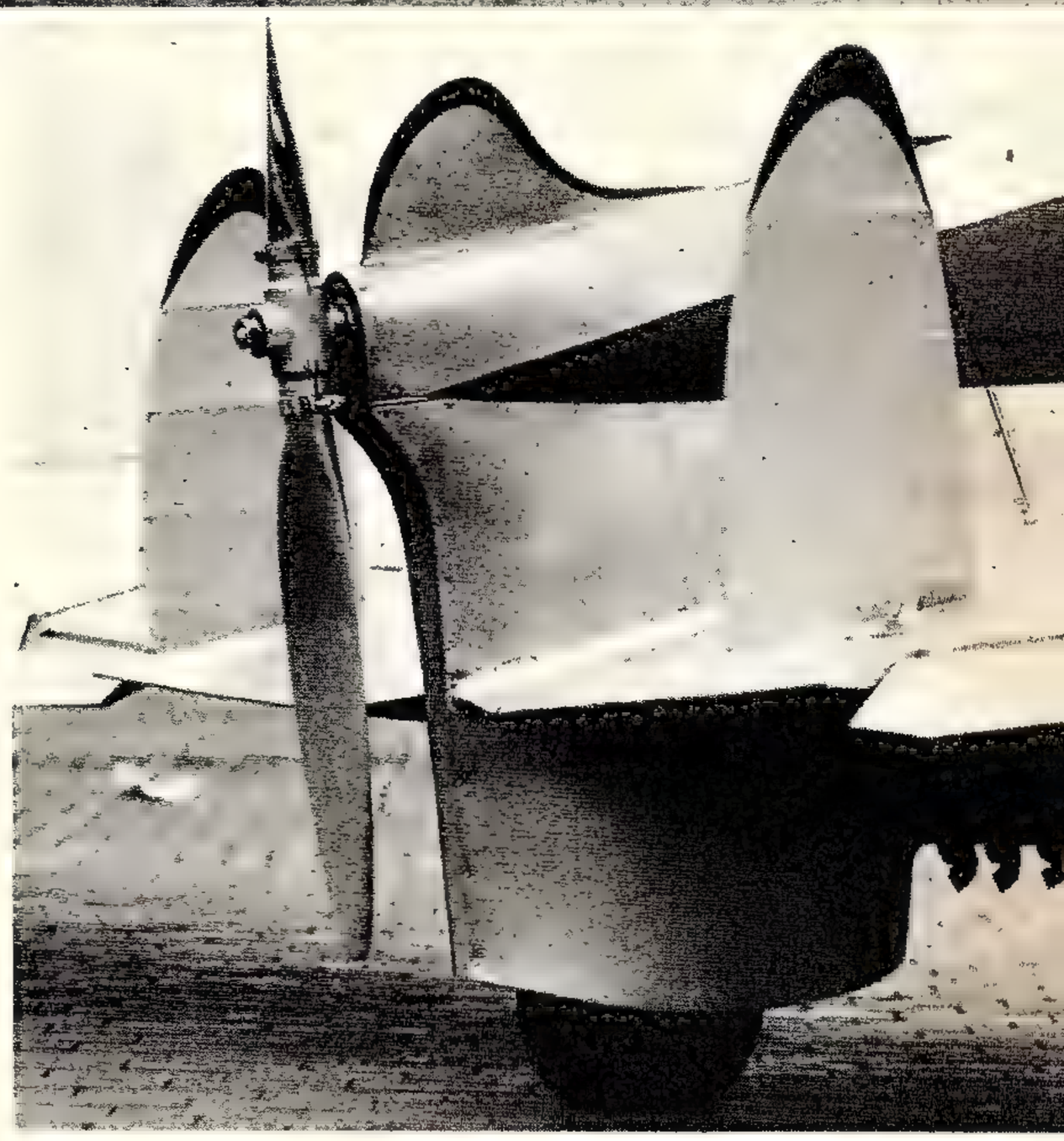
Each of the three 10-ton propellers used in the "upside-down" dam (below) is capable of blowing 7,500 feet of water per second through the concrete discharge vents.



CONSTRUCTED on Turtle Creek near Pittsburgh, Pa., by the Westinghouse Electric & Manufacturing Company to protect the vast industrial district from floods similar to those which devastated it in the past, a huge "upside-down" dam features three 5,000-horsepower electric motors which rotate three 10-ton propellers that spin the creek water upwards through vertical wells from which it is deflected into horizontal chambers, permitting the flow to expand gradually before it is emptied from outlets on the downstream side of the dam gates.

New Tailless Plane May Be Valuable War Weapon

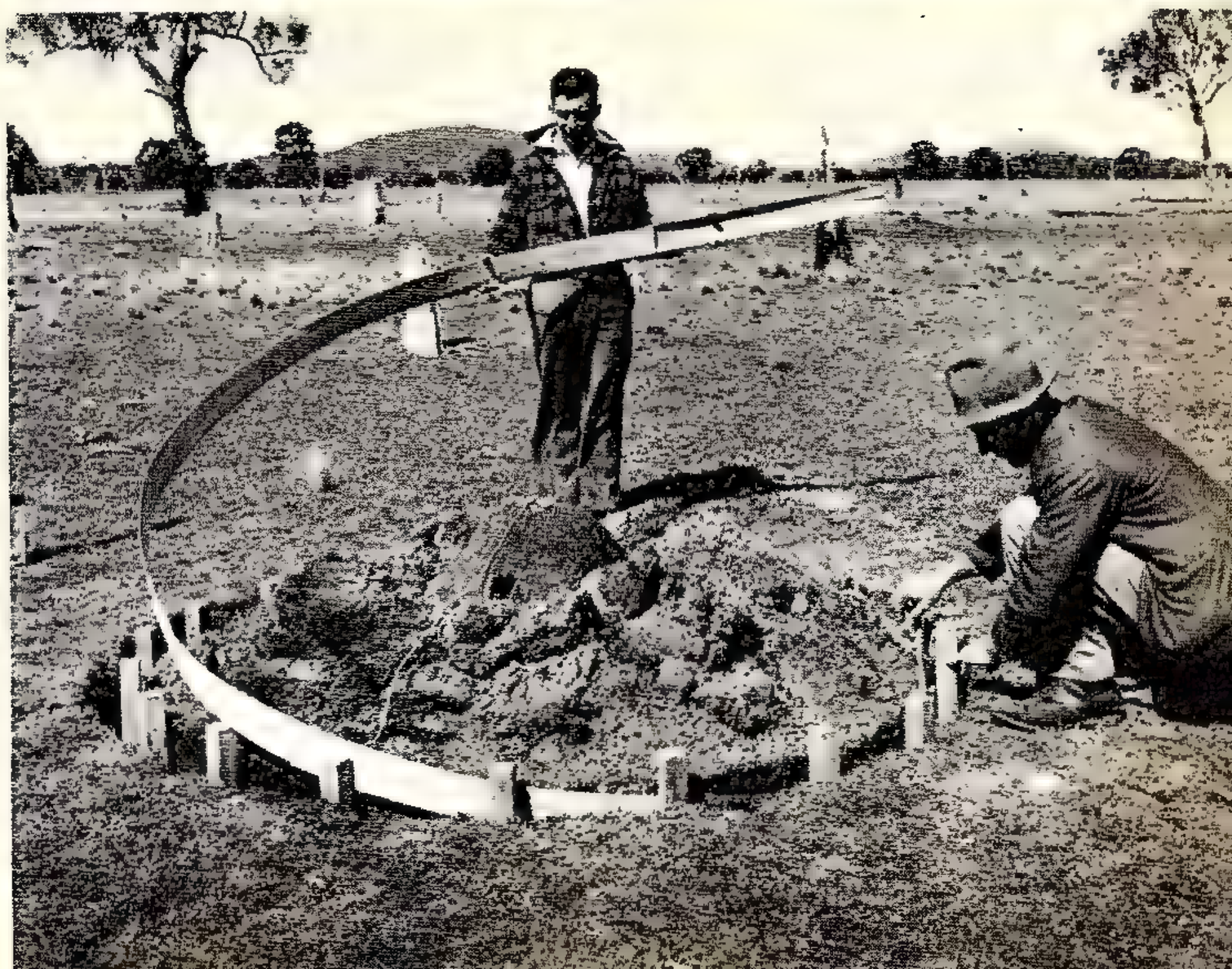
POWERED by a 95-horsepower engine and capable of a 120 m.p.h. speed, a new pusher type tailless airplane was recently tested at Floyd Bennett Airport in Brooklyn, N. Y., by James A. Taylor, Jr., well known test pilot. Still in the experimental stage, the novel plane is said to have already attracted the attention of the War Department because of its military possibilities since the plane's design would enable a machine gunner to shoot directly back, unhampered by a tail structure. The test plane is a two-passenger cabin model and is expected to be inexpensive to build commercially because of the saving of materials which ordinarily are required for a tail assembly. The photograph at the right shows a close-up of the plane's propeller mounting and two of its four wing rudders.



Termite Resistance Of Wood Proved By Test

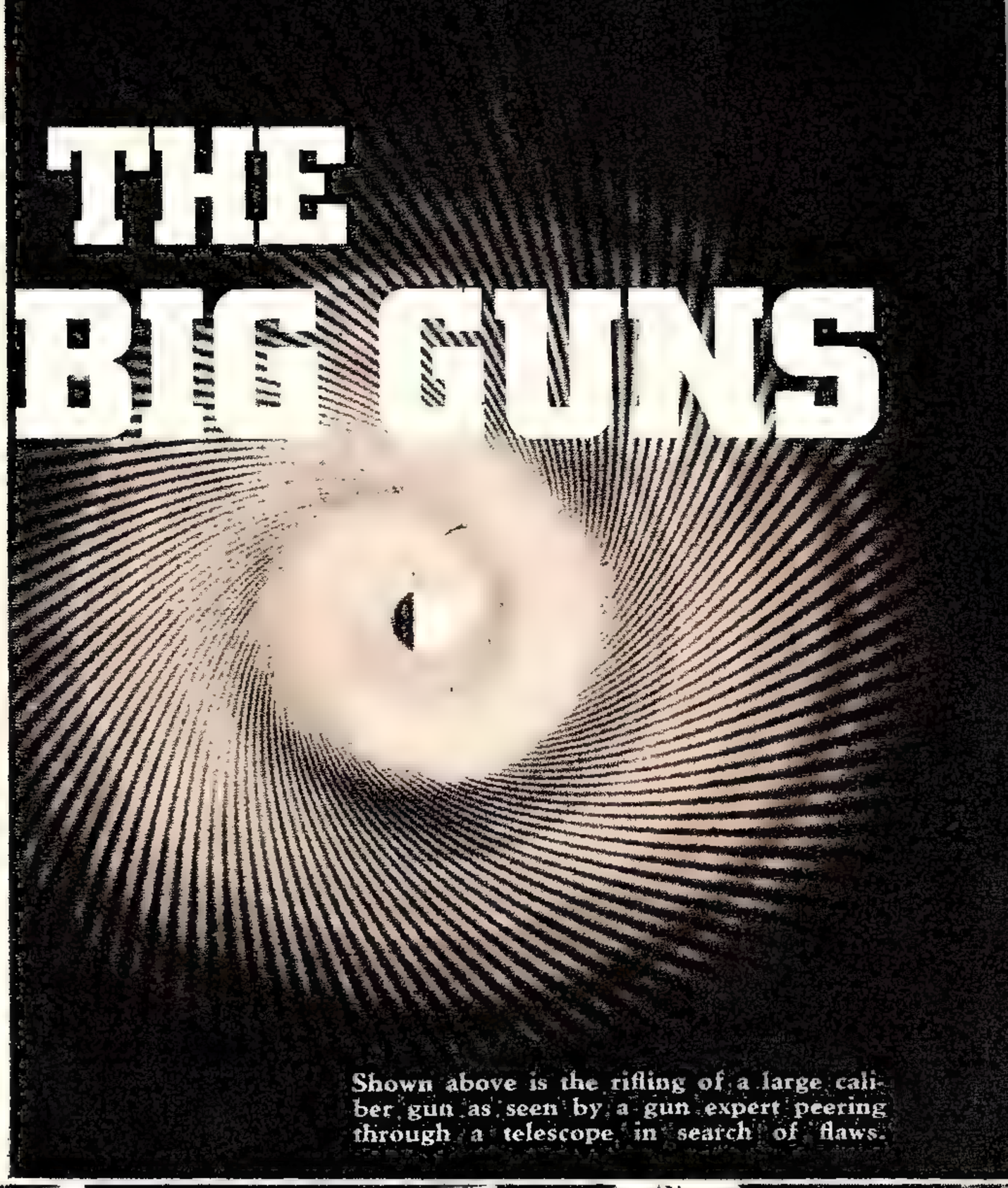
SCIENTISTS in Australia have devised an effective method of testing the termite resistance of various woods. Sample pegs are set in a circle around a termite mound, and just inside the ring of pegs a strip of susceptible timber is then laid down, as shown in photo, to make sure the termites will follow it to each peg.

formerly Modern Mechanix

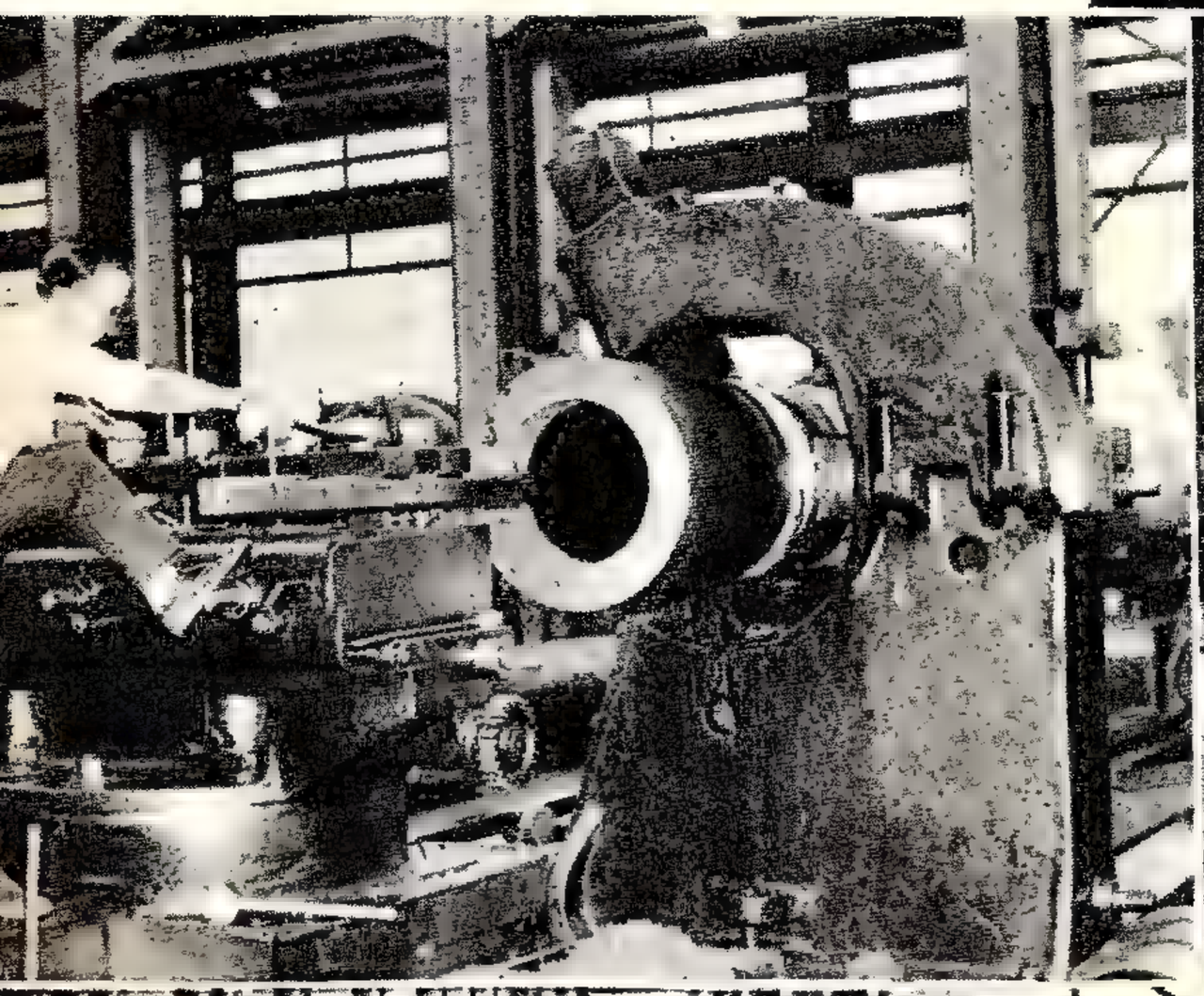


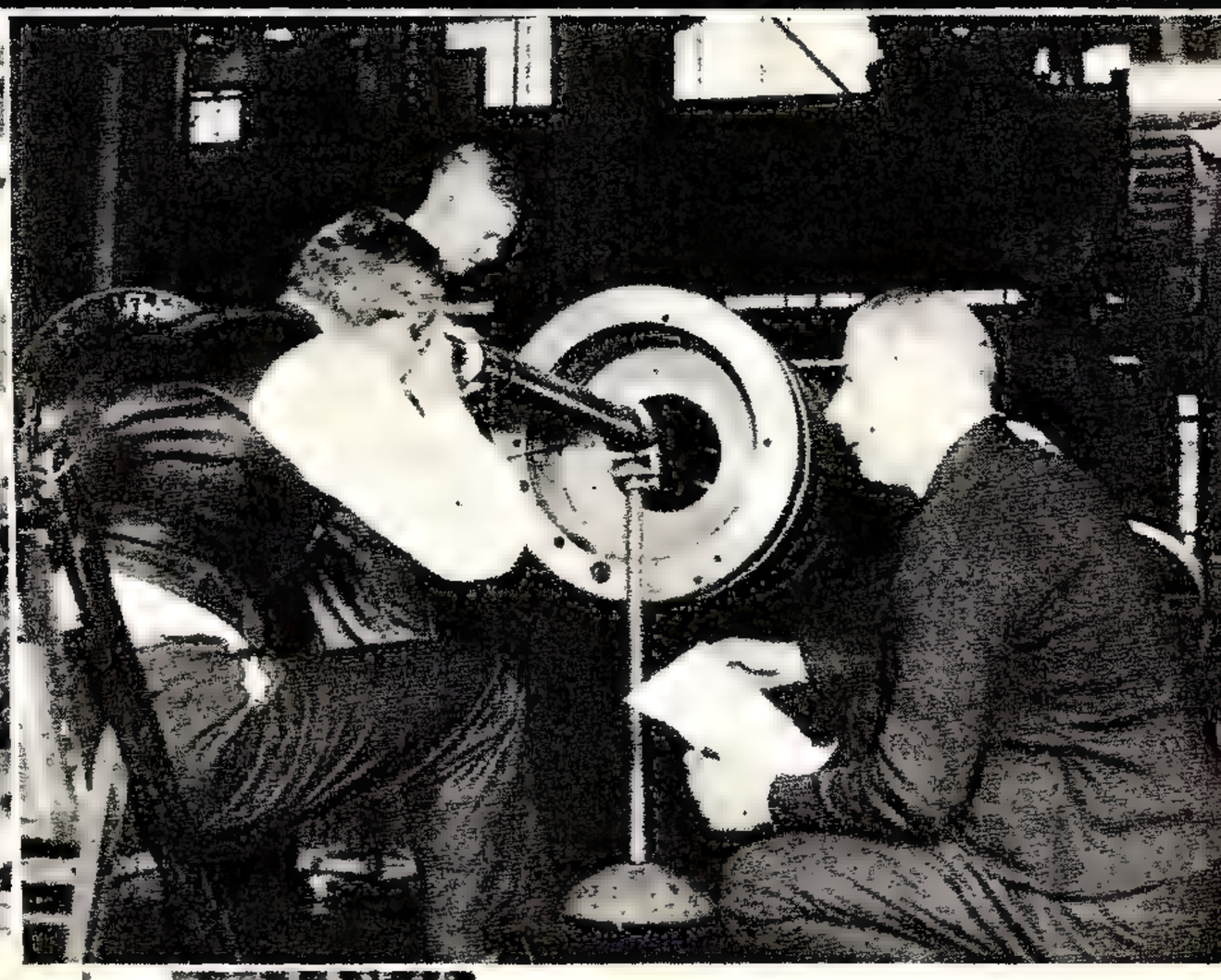
BUILDING NAVY'S THE BIG GUNS

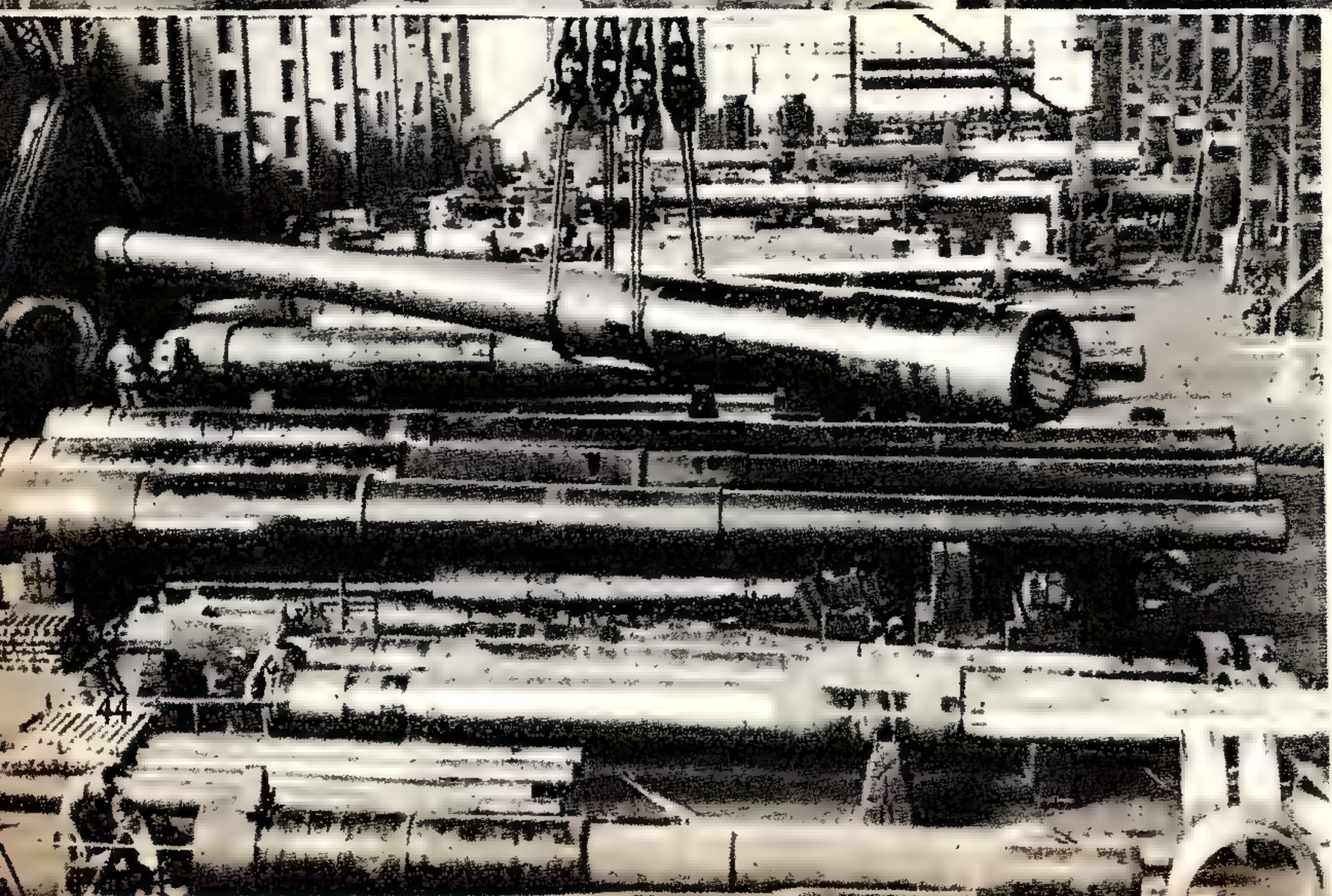
THE persistent rumblings of war emanating from Europe have tended to make Uncle Sam look to the state of his armament and, because the Navy is still considered the backbone of defense, a billion dollar construction program designed to place the Navy on a par with that of any other major power has been voted by a fearful congress. Battleships, submarines, destroyers and airplanes—all will be added to the fleet as fast as shipyards and factories can turn them out. The photographs on this page show large caliber guns being built at the Washington, D. C., Navy Yard for installation aboard battleships.



Shown above is the rifling of a large caliber gun as seen by a gun expert peering through a telescope in search of flaws.







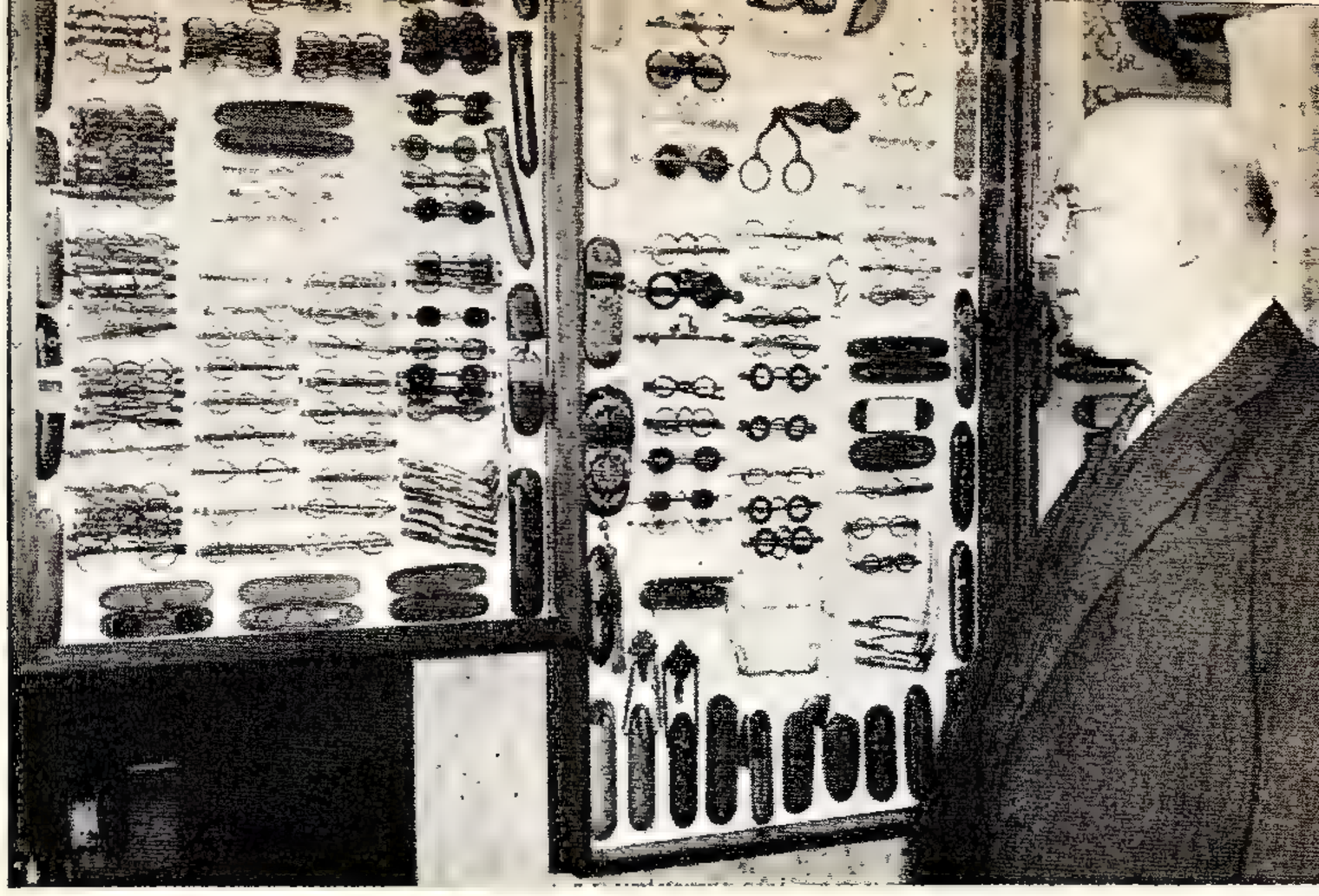
A defective gun can cause more havoc to a battleship crew than a well-placed enemy shell, so experts (above) carefully check the rifling of each large caliber gun with a telescope.

In the photo at the center, left, a worker in the gun factory at the Navy Yard in Washington, D. C., is shown using a giant lathe to bore a man-o'-war's gun to the required caliber.

Shown at the left are some of the big guns built at the Naval factory to keep pace with the needs of warships under construction and replacements for ships already in commission.

Hobbyist Collects Antique Spectacles

COLLECTING antique spectacles, many of which are now priceless, is the unique hobby of Dr. Charles Berger, of Atlantic, Mass. The most unusual spectacles in his collection are of Chinese origin, dating back about 300 years. Some of the prized antiques feature frames made from shark skin and brass with lenses made from quartz and crystals.



Ventriloquist's Dummy Gets Mechanical Legs

"A MILE a day keeps the termites away" is the new slogan adopted by Charlie McCarthy, world famous ventriloquist's dummy, since his master, Edgar Bergen, popular radio star, provided him with a pair of mechanical legs which enable him to walk upright when guided by Bergen's hand. The popular radio team is shown at right.

Tanks Feature Wire Cutters

TO ELIMINATE the danger of trailing wires becoming snarled in their caterpillar treads, Polish army tanks are now being equipped with wire cutting devices. Hitherto it has been the practice for the tanks to simply crush their way through entanglements, snapping the wires and knocking down posts, a practice that sometimes resulted in stopping or, at least, slowing up the "tin wagons."

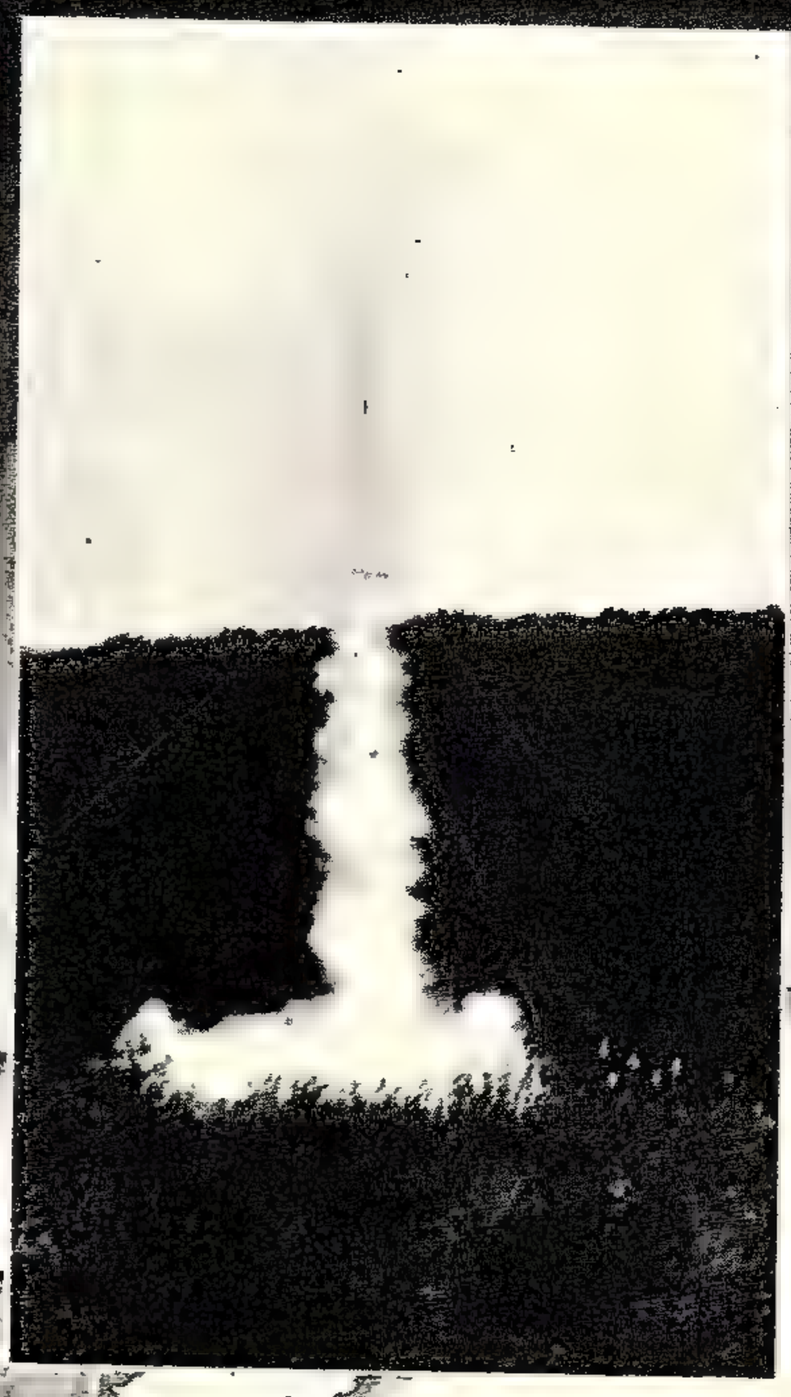
Sets New Sailplane Record

FLYING a German sailplane, Lewin Barringer, of Philadelphia, Pa., flew 210 miles from Wichita Falls, Texas, recently, setting what is believed to be a new American glider record. The old distance record, held by Richard du Pont, president of the Soaring Society of America, was 158 miles. Barringer's record cannot be accepted officially until the barographs which he carried on his flight have been checked and approved by officials of the National Aeronautic Association in Washington, D. C.

10,000 Miles an Hour!

by Allan Finn

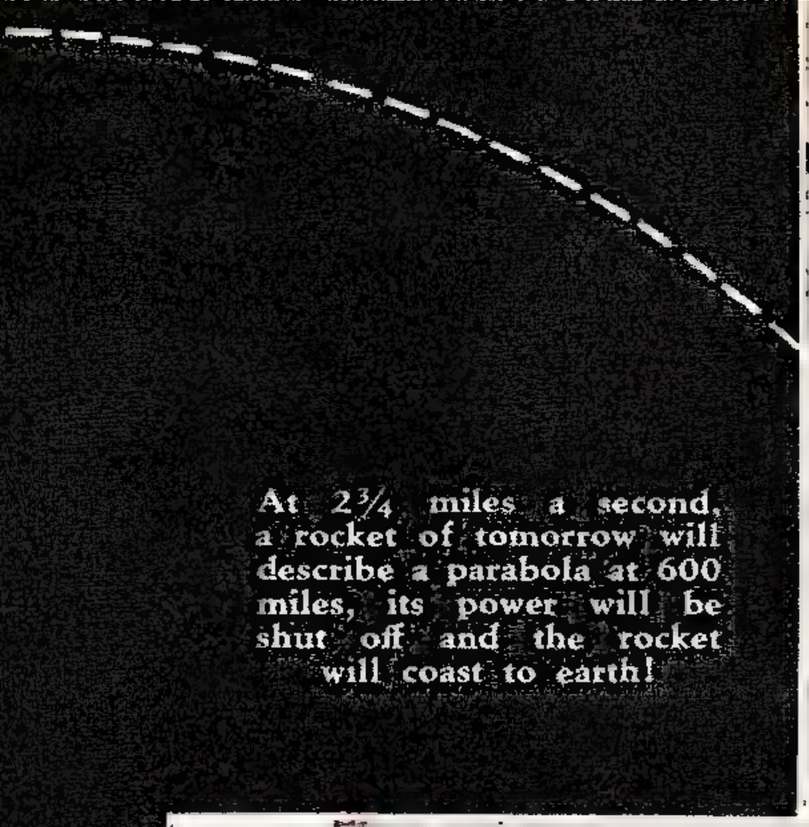
Rocket flights of tomorrow will circle the earth in 3 hours—maybe.



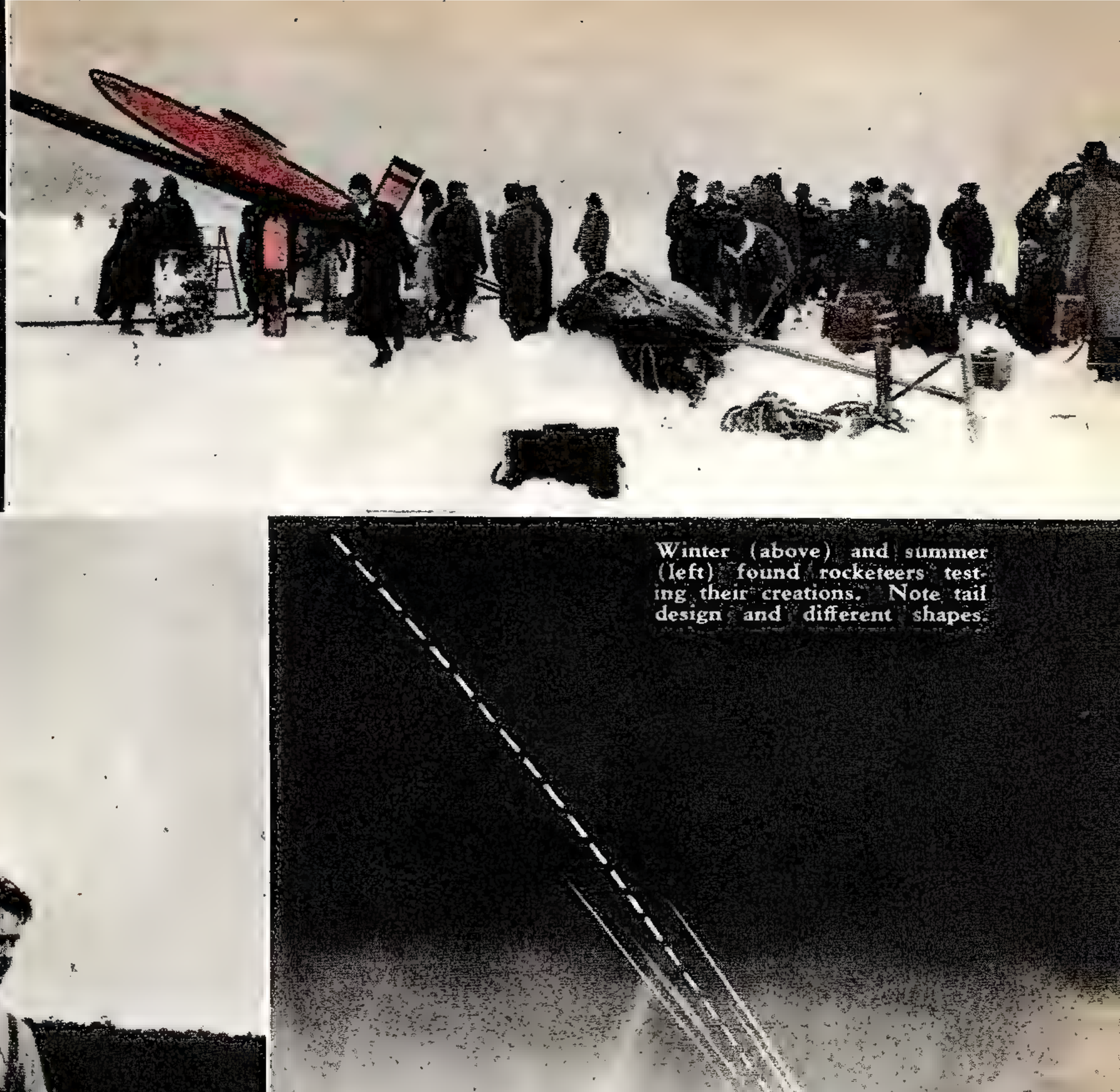
Recent tests at Pawling, N. Y., showed promise. A roar and a cloud from the exhaust—and the rocket streaks skyward at 700 m.p.h.

WALK past almost any flowered field or meadow from Connecticut to California these fine summer afternoons and as likely as not you'll see little knots of agitated men puttering with strange-looking contraptions which hiss and let off gaseous odors. Edge over to satisfy your curiosity and some of them will come running up warningly to shoo you away.

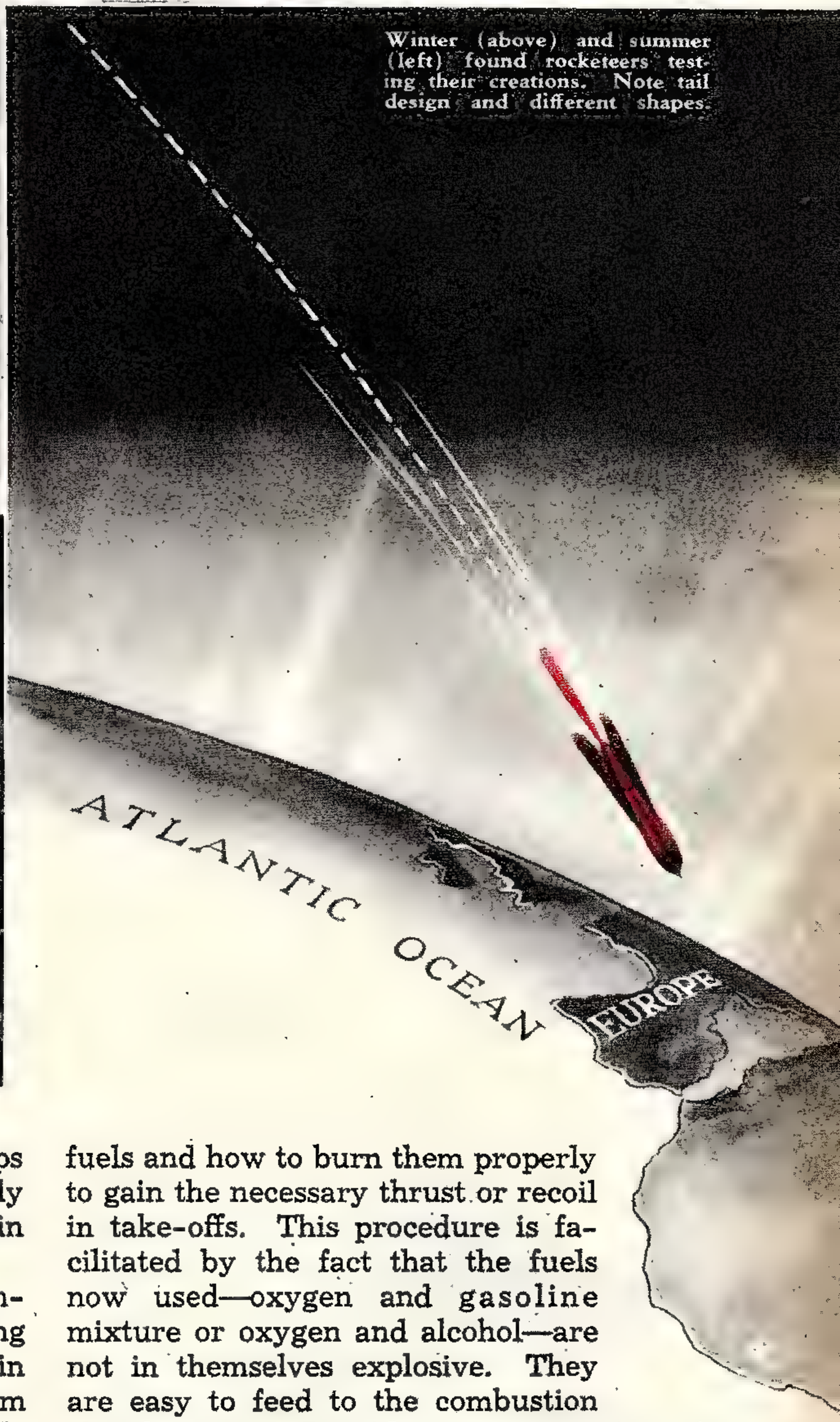
There's a good reason for the presence of so many mysterious looking men. Rocketry is making tremendous strides in its development as an embryonic science. Over the past winter there have been many important



At 2¾ miles a second, a rocket of tomorrow will describe a parabola at 600 miles, its power will be shut off and the rocket will coast to earth!



Winter (above) and summer (left) found rocketeers testing their creations. Note tail design and different shapes.



developments in cellar and garret workshops everywhere. Under the clear skies of July and August tests are being made to ascertain their practical value.

For one thing, a dozen new motors—combustion chambers with their flame-emitting nozzles—are undergoing trials. Tests now in progress have definitely passed rocketry from the hobby to the engineering stage. Its rule of thumb days are over, its votaries the aerial giants of tomorrow.

In this transition the two basic problems of the science have been conquered, to-wit: how to use and control explosive and volatile fuels and how to burn them properly to gain the necessary thrust or recoil in take-offs. This procedure is facilitated by the fact that the fuels now used—oxygen and gasoline mixture or oxygen and alcohol—are not in themselves explosive. They are easy to feed to the combustion chamber, too. Liquid oxygen is automatically forced from its tank into the burning compartment by the pressure of its own evaporation.

Gasoline or alcohol is pressed inside by compressed carbon dioxide or nitrogen. Flow

of the intermingling fuels also is controlled by valves.

Moreover, rocket men have developed motors with sufficient thermal efficiency—about 10 per cent—for present experimental shooting requirements. In addition a number of smaller problems relating to dynamics and aerodynamics have been solved or nearly solved.

Armed with these substantial achievements experimenters confidently believe that rocket flights of 25 miles are close at hand, flights of 100 miles around the corner and flights across the Atlantic a definite possibility within our lifetime. More, they believe there is plenty of theoretical basis and some evidence for the conviction that given enough money, power, experimental data, they could shoot their devices to the moon.

Although such flights at present are only in the realm of speculation, rocket ships for them have been designed and the problems of their propulsion and navigation worked out on paper. Ocean-flying rockets would be shaped like a needle, hermetically sealed and steered with gyroscopic fins. Of several compartments, the front of the rocket would be occupied by passengers and crew. Abaft of them would be the fuel tanks, the motor, gyroscope and parachute for descending.

Loaded and ready for a flight, say from Long Island to London, the Atlantic rocket would be assisted in its takeoff by some auxiliary. It might be pushed by a powerful locomotive on a sloping rail, catapulted by a titanic wheel or hurled from a cannon's maw after the fashion of Jules Verne's projectile.

Once in the air, the rocket would soar through the stratosphere at an estimated maximum of 10,000 miles an hour, about 2¾ miles a second. After describing a parabola at 600 miles, its power would be shut off—by cutting the fuel tanks—and the rocket would coast to its destination. A few miles before landing a parachute released from the rear would check the terrific speed. Thus controlled, the ship would slide to a rest on a wheeled car in a long runway!

Such a flight, it is estimated, would be made in 50 minutes!

Compared with these ambitions actual accomplishments in the air no doubt have been small. Yet they have been no less substantial. Mail, for instance, has been shot over the mountains near Graz in Austria. A live rooster has been catapulted in a rocket over a river in India. There have been rocket glider flights in Germany; test flights of

Above: Rocketmen carefully check their machines with a battery of meters and test combustion (as shown at left) before a flight. Note the testing panel and men crouching behind protecting wall. Rocketman G. E. Pendray (above center) supervises rocket experiments.

rocket-propelled pilotless planes at Greenwood Lake, N. Y.

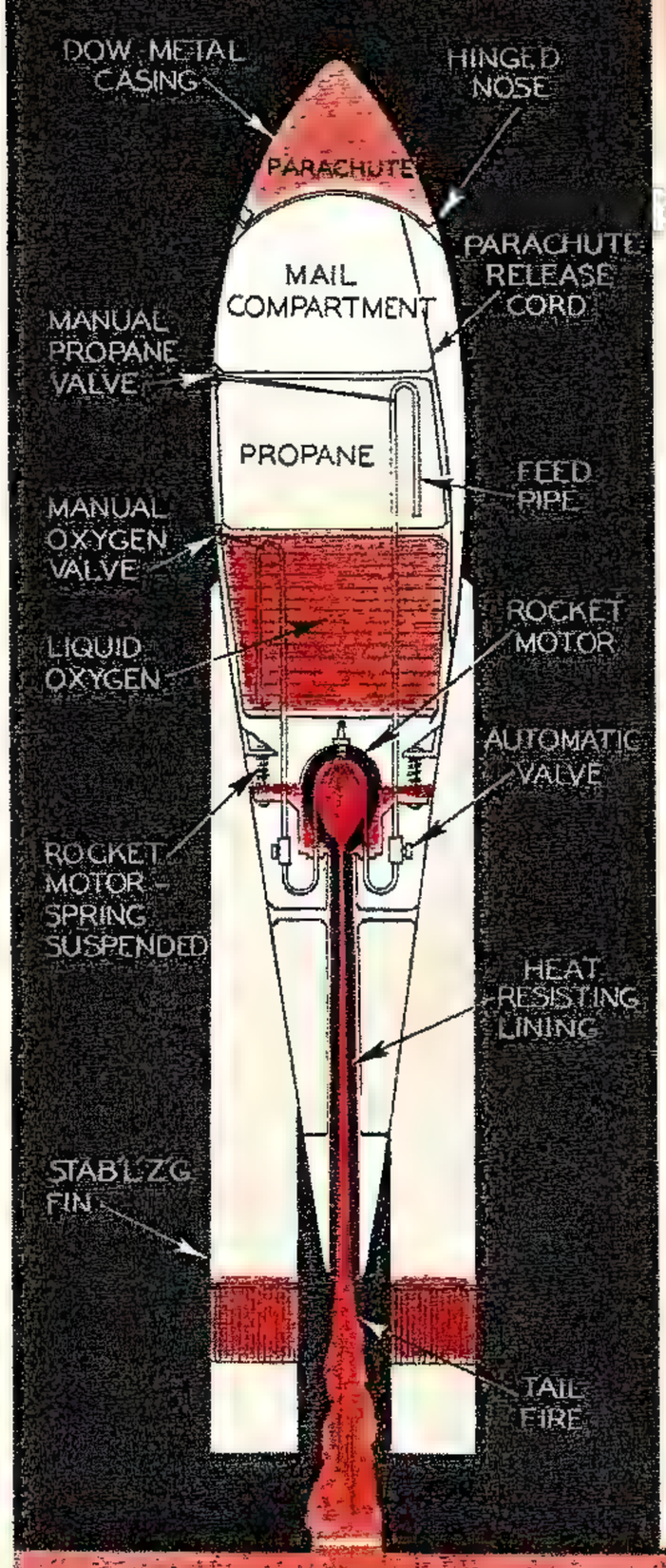
Dozens of dry and liquid fuel rockets, of course, have been sent up with varying success. At present the altitude record for a rocket stands at 7,500 feet. It is credited to Dr. Robert H. Goddard, dean of rocket experimenters. He set it at his laboratory near Roswell, New Mexico, in May, 1935. Doctor Goddard's rocket attained a speed of 700 miles an hour.

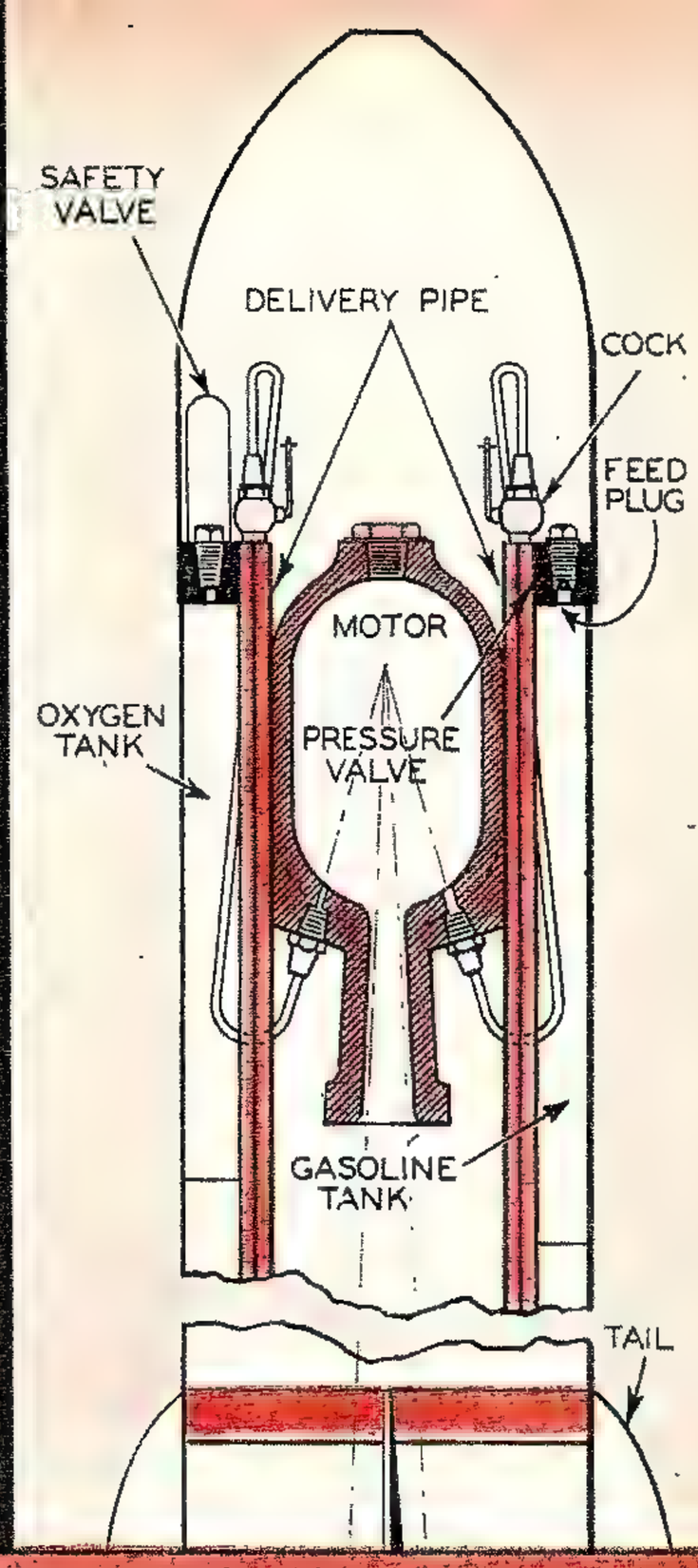
Dr. Goddard launches his rockets from a 60-foot rack. The rockets are about 12 feet long, 9 inches in diameter, weigh from 30 to 80 pounds. The actual motor is about 5¾ inches in diameter and weighs about five pounds. Fueled by gasoline and oxygen, these rockets are steered by a delicate gyroscope whose spinning wheels, affected by any change in direction, control vanes guiding the course of the exhaust flames.

Firing, which Colonel Charles Lindbergh, a rocket enthusiast, has witnessed as Doctor Goddard's guest, is simple. The fueled rocket is put on the rack and ignited by a fuse set off electrically from a telegraph key. A blast of white flame issues from the nozzle, and with a terrifying swish the rocket slowly rises from the tower. In a flash it is zooming like a thousand hissing vipers in the sky. The rocket undulates from side to side as the gyro continually corrects its skyward course. On one flight, Doctor Goddard reported, the rocket reminded him of a fish swimming in a vertical direction.

Doctor Goddard has developed motors of sufficient strength to resist the effects of constant firing and he believes he has the stabilizer problem licked. Currently, he is working on weight reduction of his rockets.

As recognition of the public's inquiring mind, the New York World's Fair has prepared a transportation unit with a hypothetical rocket car.





Above left: Cross-section of a designer's conception of a mail rocket showing mail compartment, parachute and rocket motor. Above right: Cross-section showing details of the motor. Below: The start of a rocket flight. Note tower and shape of rocket. Such tests presage flights of tomorrow.

In Germany it is reported the military scientists there have developed a rocket cannon capable of shooting a thousand miles.

The United States Weather Bureau in Washington has been keenly watching developments. It has agreed when rocket men are ready, to allow them the use of delicate

[*Continued on page* 139]

"GAS-POWERED" FLYING MODELS PROVIDE THRILLS

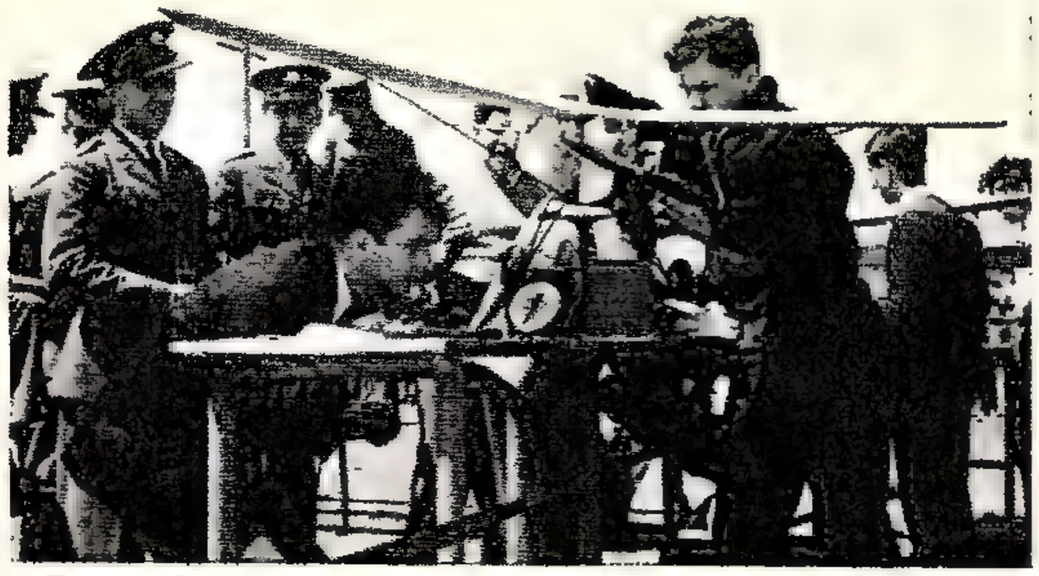
Left—Many a contest is won in the "pits", the roped off areas where the modelers are permitted to adjust the miniature gasoline engines of their entries. The adjustment of the carburetor needle-valve often means success or failure of the flights.

Below—Will she get off safely? It's an anxious moment as a contestant guides his model into the wind for the takeoff. If the wind is steady and the model is adjusted properly, all will be well. If not—crash!
(MI Staff Photos)

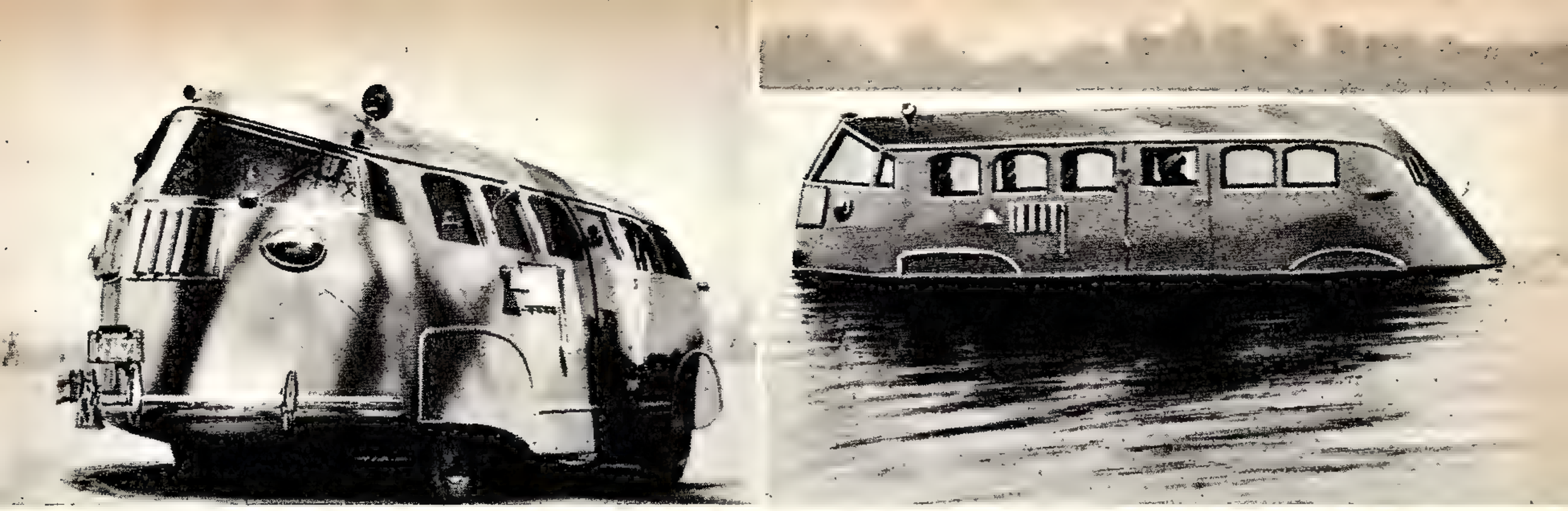
This contestant (above) is carrying his five-foot model to the takeoff spot. Two timers keep check of each model's flight.

THE wasp-like buzz of thousands of miniature gasoline engines mounted on four to ten-foot model airplanes is being heard on hundreds of airports throughout the country these days. Zooming, diving, climbing—yes, and crashing, too—the miniature aircraft are providing thrills for the spectators and increasing the aviation knowledge of their builders, young and old.

The development of satisfactory air-cooled engines of one-fifth and one-quarter horsepower, which weigh but a few ounces, spurred activity in the model aviation field a year or so ago, attracting the advanced modelers who had outgrown rubber-powered models. Contests sanctioned by the National Aeronautics Association are held at regular intervals throughout the outdoor season.



Weighing in. The models must weigh 8-10 ounces (according to rules set) per square foot of wing area. The motor run is limited to 30 seconds, being controlled by mechanical timers.

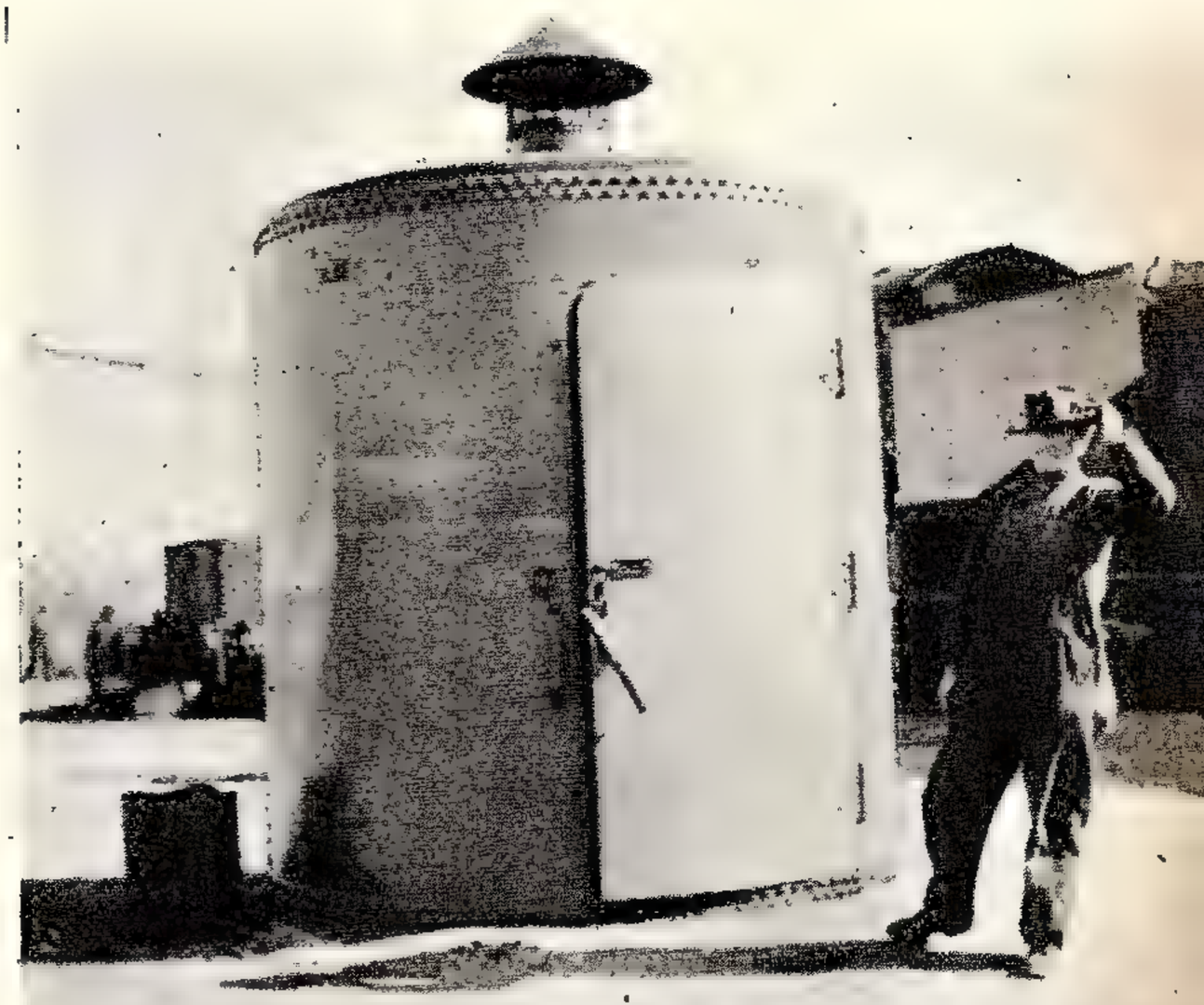


Home-Built "Autoboat" Operates On Water Or Land

REQUIRING six months to construct and representing an investment of $4,000, an 11-passenger "autoboat" built by John Calvaresi, his son Archie, and Mr. T. Grabbe, of Denver, Colorado, is said to travel 25 m.p.h. on water and 100 m.p.h. on land. In driving from land into water, the operator simply disengages the gears for the wheels and engages the gears connected to a propeller, using the same clutch for both. Seven air tanks are mounted on the underside of the body to provide flotation for traveling on the water.

Tank Car Sections Serve As Storage Houses For Paints

OLD railroad tank cars that have outlived their usefulness on the road are being converted into fire-proof paint storage houses by the Southern Pacific Company, as shown in the photo at right. The tanks are removed from the car trucks and the end sections cut off, the sections then being placed on end and an air vent cut in the tops. A door is then cut out on one side and fitted with three large hinges after which circular shelves are welded to the inside of the tank, providing plenty of room to store the paints and other inflammable liquids.



Boat Models Built Of Wood Blocks

CONSISTING of odd-shaped wooden blocks, which are held together by means of wooden and metal "keys," a newly developed educational toy enables children to construct 13 different boat models as well as originate models of their own. In the photo at right, a youngster is completing a model of the *Queen Mary* built with the blocks.

GIANT Pictures

LIKE all big things that have a small beginning, the making of giant photomurals was just a little idea back in 1927, when Mrs. C. B. Goodspeed of Chicago walked into the photo studio of Kaufmann & Fabry. She carried with her a 4x5 negative of India's famed Taj Mahal and explained to the skeptical Messrs. Kaufmann & Fabry that her idea was to have a picture large enough to cover the entire wall of an alcove in her home.

"We told her at once," said Arthur E. Clason, the veteran photographer who eventually completed the job, "that a picture the size she wanted had never been made before. Enlargements, as known today, were unheard of. The widest paper available was only forty inches, so three strips would be required to cover her eight-foot alcove. We were not sure printing could be controlled so that tonal values of these strips would be identical. We feared, too, that due to inability to hold the paper absolutely flat during printing, the curled edge would distort the image. Our big worry, though, was that the dampened paper would stretch without uniformity. There was also the possibility that, due to

Below—Taj Mahal, famed temple of India, was Kaufmann & Fabry's first giant mural. Left—The giant Ford mural is 600 feet long, 20 feet high.

From Pigmy Prints

by H. H. Slawson

Huge pictures from tiny negatives have set a new style in interior decoration. A woman's whim started it.

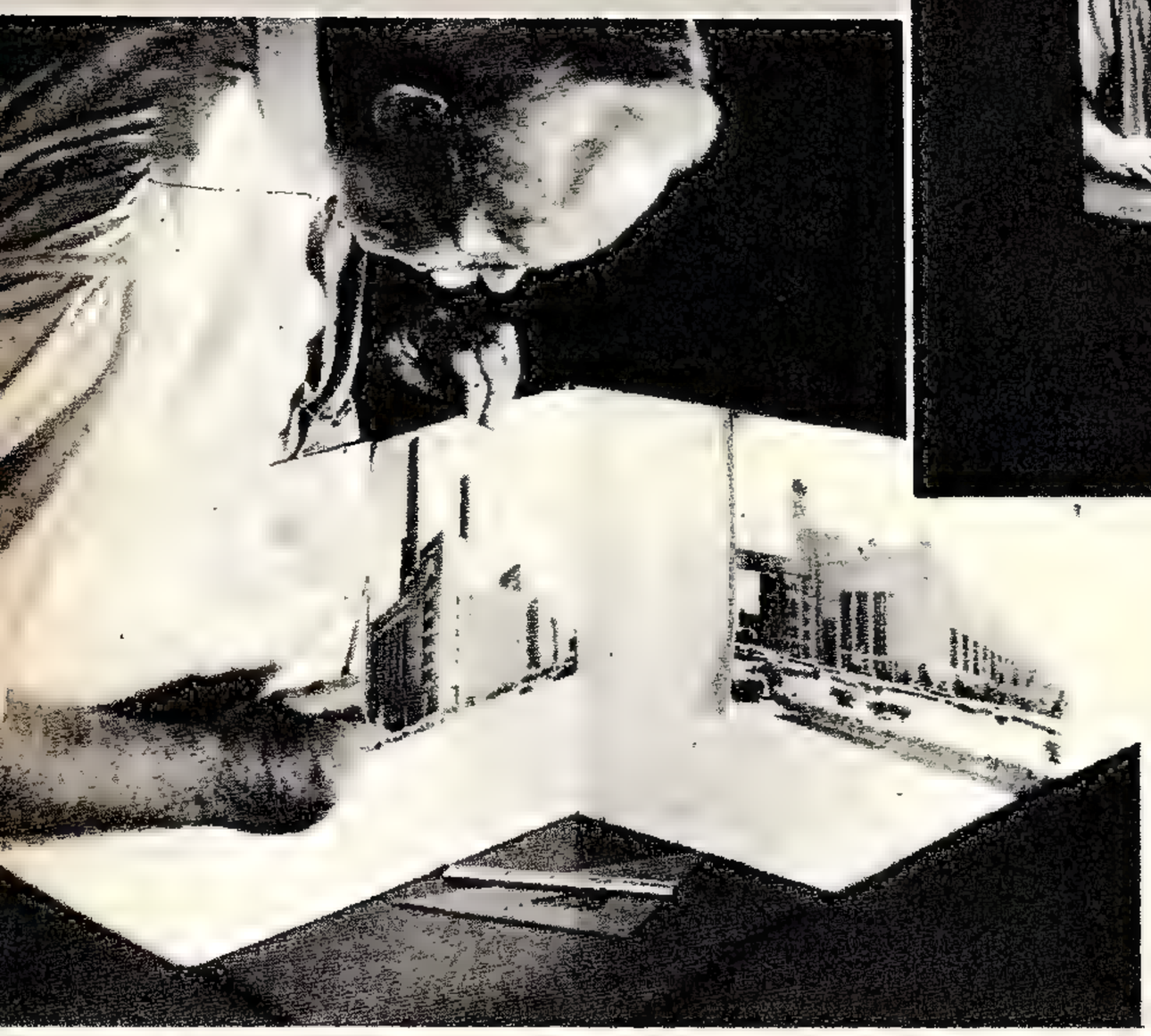
improper development, the emulsion on the negative would show a blotched or 'grainy' appearance when enlarged to the unusual size, thus destroying the artistic tone of the finished picture."

Mrs. Goodspeed departed but did not give up. And finally, when the studio consented to project the negative, it was found to everyone's surprise that it had been correctly exposed and developed. Even when enlarged to twenty-five diameters on the screen, the superior quality of the negative nullified all opposition to the undertaking. After that showing the studio was compelled to accept her order.

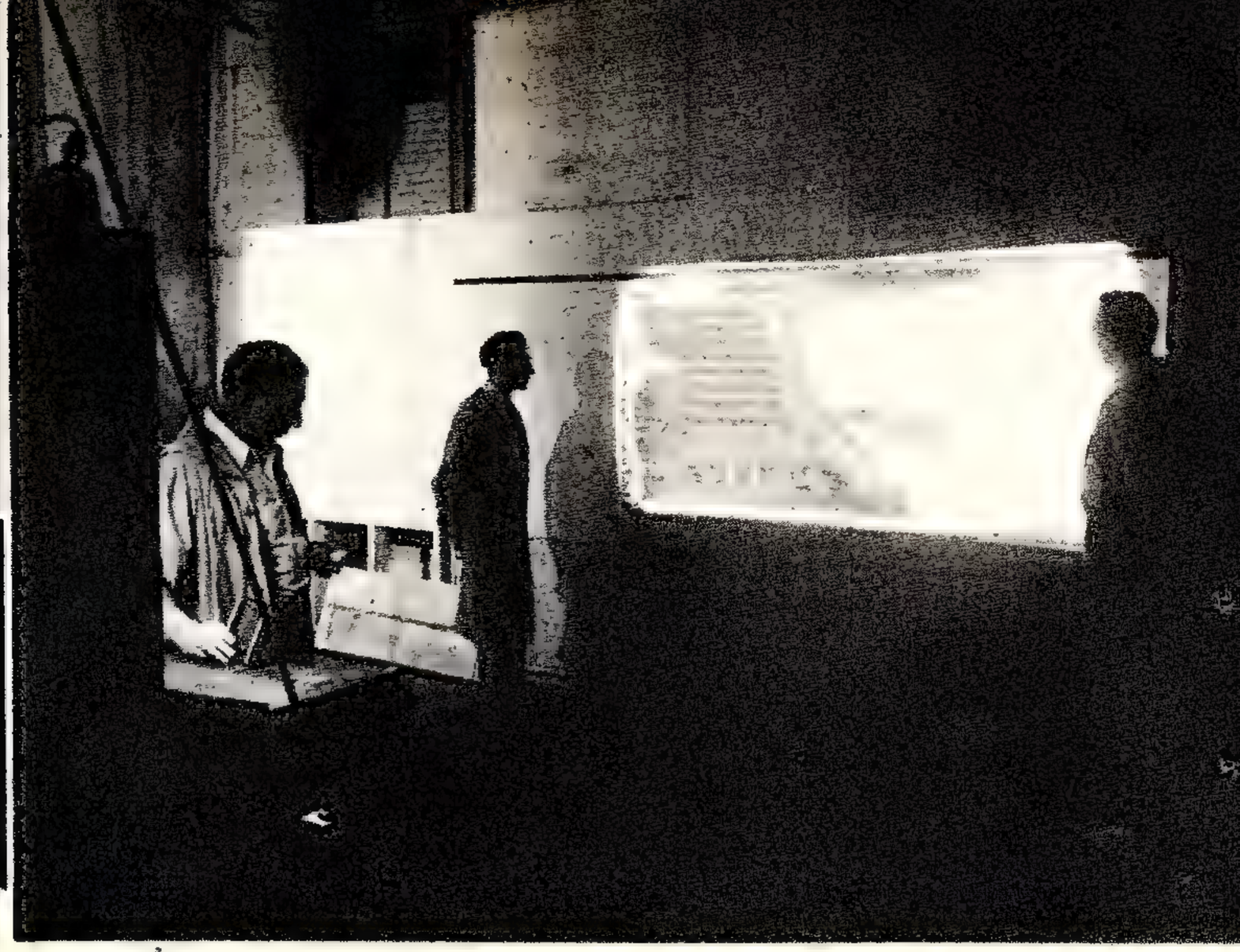
"We realized that we were attempting something without knowing the rules, but there was nothing hit or miss about our procedure. Every step was carefully plotted out and our subsequent operations have closely followed that first experience. When the strips were eventually joined on the alcove wall, the images matched within less than a quarter of an inch.

"Mrs. Goodspeed provided the paperhanger, but we furnished paste, just to be

Below—Photomurals made the artistry of this room possible. Right—Final retouching is done on the enlargements themselves. Note the contrast in size between man and picture.



Below—A scale model of the room is first designed to study decorative possibilities. Right—Photographic paper is tacked on a wall and the negative image projected on it.



sure he did not use anything injurious to the emulsion. The paper was applied direct to the plaster, which, as learned from later experience, might have brought disaster. This first job was saved, however, because Mrs. Goodspeed had asked for a 'gold tone' finish and $50 worth of pure gold bullion was used to produce it. Between that gold coating and the lime no chemical action occurred and today, after nearly twelve years, the world's first photomural still hangs there in all its original bright perfection."

It was not until three years later, in 1930, that the commercial possibilities of photomurals was realized by Kaufmann & Fabry, when they were asked to decorate the walls of a Chicago night club's reception room. Here, after preliminary consideration, a drawing, 6x20 inches in size, the work of the artist, Aaron Douglas, was enlarged to fill every inch of wall space in a room measuring 51x20 feet.

The accomplishment attracted widespread attention and discussion in art circles. Interior decorators began placing orders and then came Chicago's Century of Progress Exposition, which, as Mr. Clason remarked, was "practically baptised with a photomural."

H. M. Pettit, the artist who specializes in bird's eye drawings, had made a picture visualizing how the fair would look when completed and the exposition's president, Rufus Dawes, thought it would make a fine ornament for the administration building's reception room, "if it could be enlarged a bit." So Kaufmann & Fabry enlarged it quite a bit. Pettit's picture was 26x40 inches in size and the completed photomural was 20 feet, 6 inches high by 35 feet long.

"It was our first real 'whale,'" remarked Mr. Clason, "and gave us our first experience in excessive height and multiple sections. The first photomural had been made in three sections, but since our projector could only throw images about ten feet long, this fair job required thirty-three sections. Today, incidentally, sections twenty-four feet long can be printed without difficulty.

"Those thirty-three sections had to be uniform in tonal values. But variations in strength of light, temperature of developer and a half dozen other factors might combine to cause slips that could not be corrected once we had started. During hanging, expansion, both horizontal and vertical, had to be watched and at the same time moisture content of each section when applied to the wall, must be approximately equal to that in the sections to which it was joined. I stayed on that job like a hawk."

This installation introduced the world to the possibilities of mammoth photographs as a new form of wall decoration. After seeing it, fifty exhibitors placed orders for giant pictures for their 1933 exhibits. Next year this number increased and meanwhile other studios had also begun to produce the new style pictures.

Left—After development, the photographic paper is carefully washed in steel tanks each holding 400 gallons of filtered water and accommodating a print 25 feet long. Left—After thorough washing, the prints are lifted on special holders and placed on the drying racks. Below—The finished job projected by the designer on the scale model on the opposite page is shown here in the office of the plant in the photomural.

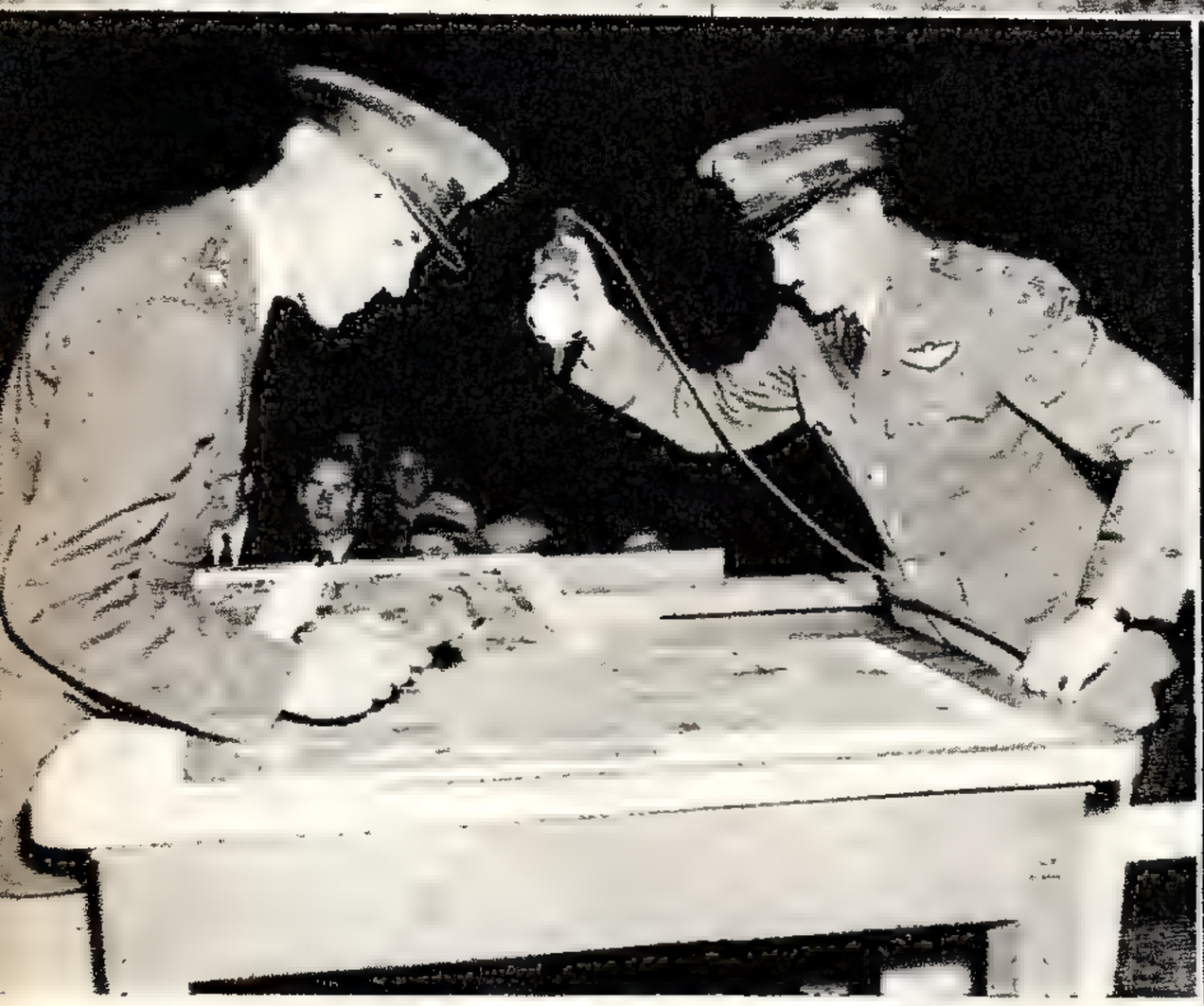
It was for the 1934 fair that Kaufmann & Fabry made the world's largest photomural for use by the Ford Motor Company. It approximates 600 feet long and twenty feet high and is composed of ninety-eight steel-framed panels. Subjects are scenes around the company's plant, made from negatives 4x5 or 8x10 inches in size. Nearly one mile of photographic paper, forty inches wide, was required, together with 12,000 feet of plywood for backing, 200 gallons of paste, half a mile of chromium metal moulding and other materials in proportion. The big picture now hangs permanently in the Ford "Courtesy Building" at Dearborn.

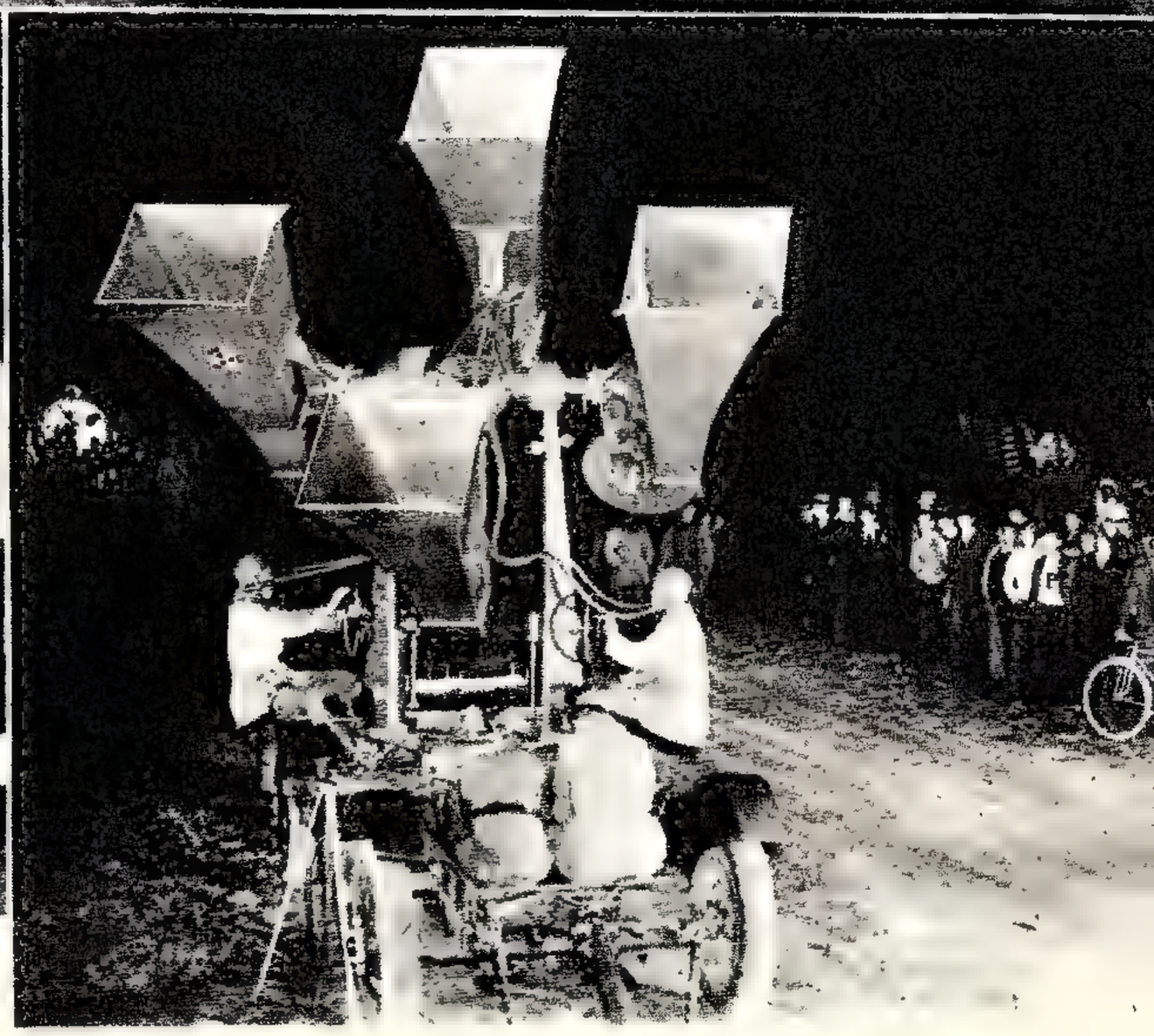
Photomurals are now employed for wall decoration and other purposes in an infinite number of situations. Some twenty distinct types have been created, ranging from the

[*Continued on page* 137]

U. S. REHEARSES FIRST AIR WAR "BLACKOUT"

Propellers flashing in the glare of a searchlight beam, a squadron of nine pursuit planes "tunes up" before taking off to repel "enemy" bombers sent to destroy the airplane factory at Farmingdale, L. I., during recent Air Corps maneuvers. The "raid" was the climax of the maneuvers.





Above—Brigadier General Fred L. Martin (left) has an aide hold a light for him as he scans a map of the area during the "blackout" of Farmingdale, L. I. Not a light showed in the town after a fire siren warned of the approach of "enemy" bombing planes. Below—Police Chief Arthur Powell clocks off the seconds as Fire Chief John Kunz stands ready to sound the siren. Right—This mobile detector unit's "ears" helped to locate the bomber fleet by picking up engine noise. Note the spectators.

CLIMAXING a series of war maneuvers designed to test the ability of the Air Corps to defend the eastern seaboard against an "enemy" attack, the town of Farmingdale, L. I., recently co-operated in a "blackout," the first ever conducted in the United States although they are commonplace drills in many foreign countries. At the blast of a fire siren, the entire town was plunged in darkness in an effort to conceal its location from a group of "enemy" bombing planes sent to destroy a local airplane factory. A defense squadron of pursuit planes then took off to locate and "shoot down" the bombers before they could unload their "bombs" on the factory.

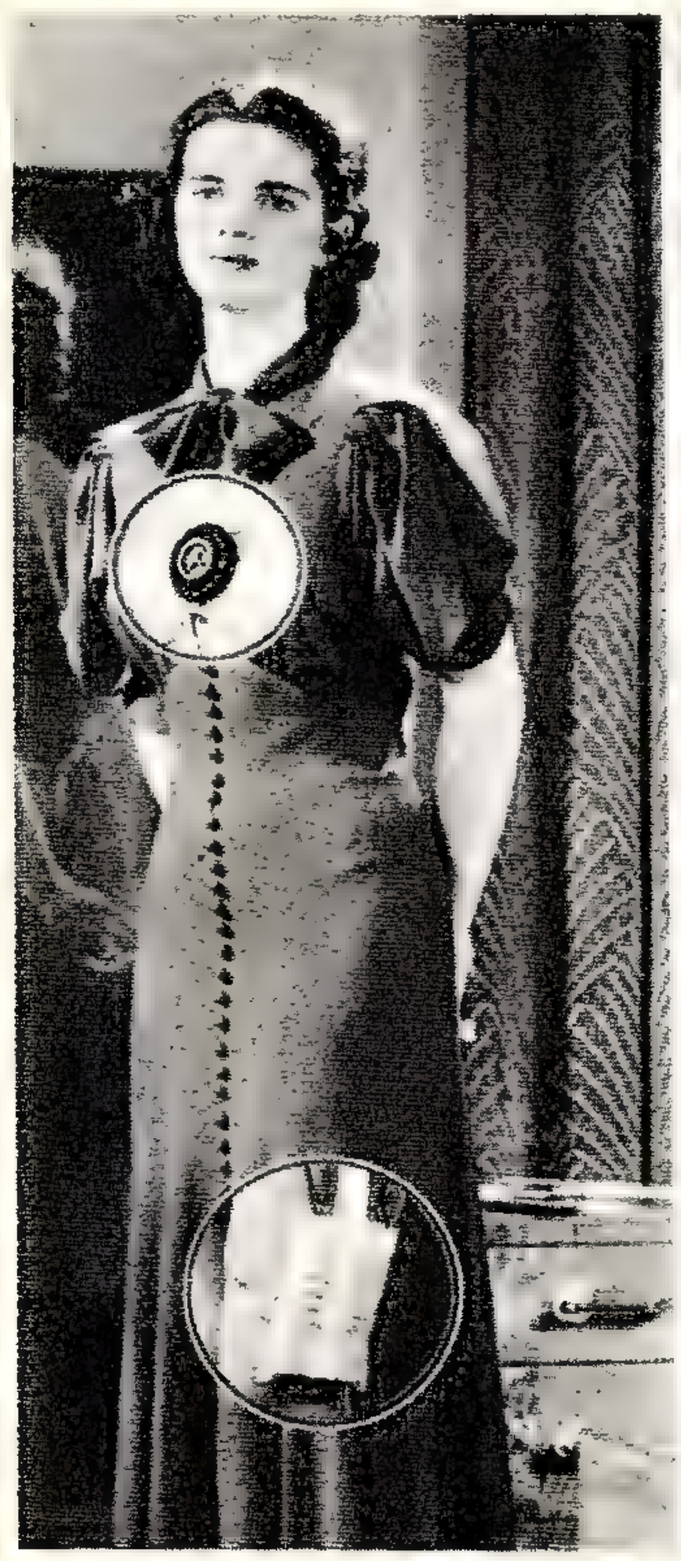
River Boat Boasts Air Conditioning

A NEW Mississippi River pleasure steamer now being constructed at St. Louis, Mo., features all-steel streamlined construction and has five enclosed decks which will be air-conditioned for passengers' comfort. The steamer is 385 feet long.

Battery-Operated Hearing Aid Is Easily Concealed

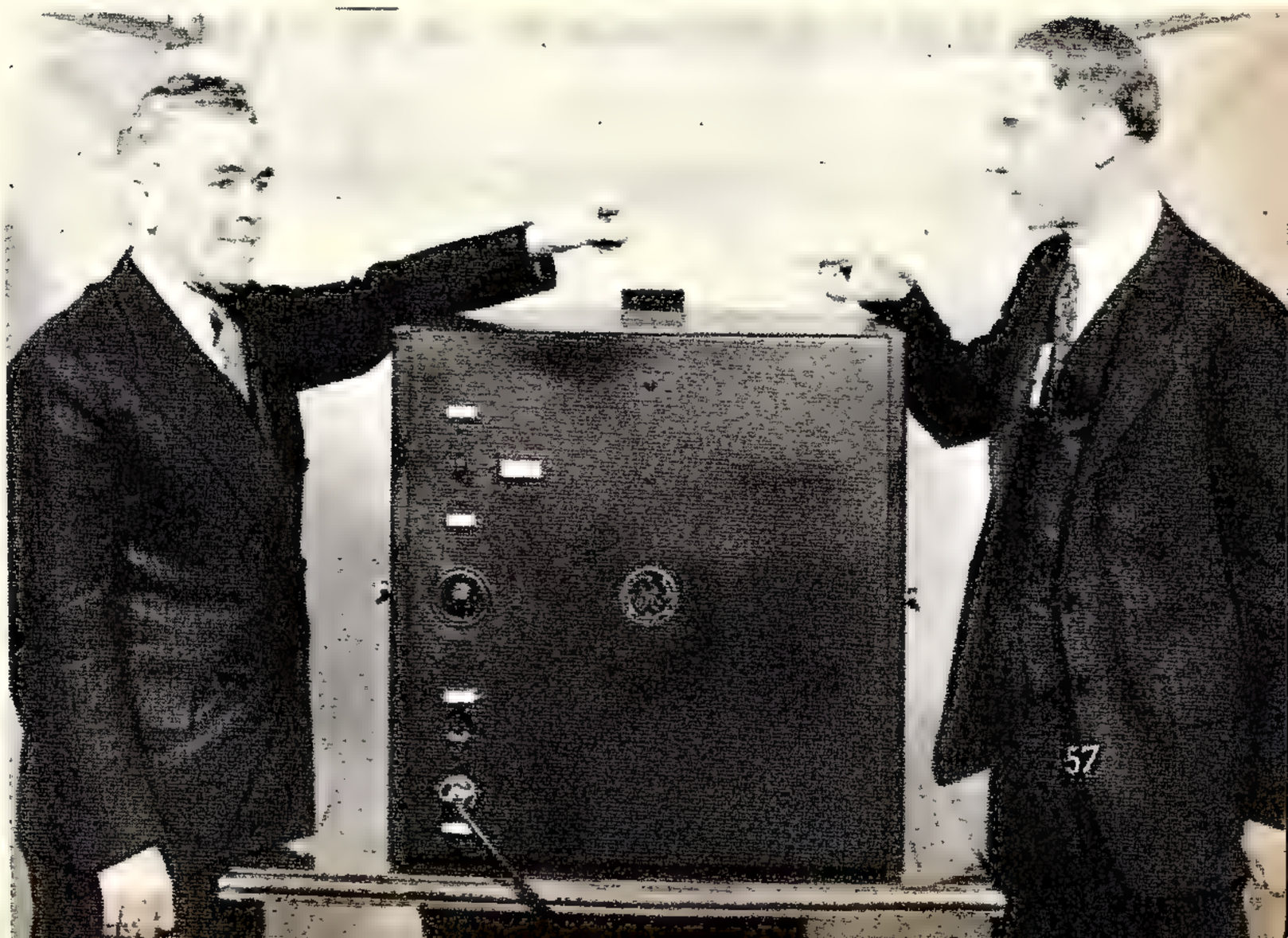
SO SMALL that it can be effectively concealed while in use, as shown in the photo at right, a newly developed battery-operated hearing aid is actually a miniature telephone of the most improved type. The device has an efficient "transmitter" which picks up sound waves regardless of whether the wearer is reclining, sitting or standing.

After the sound waves are amplified they are led into a miniature "receiver," which repeats them instantly at the point where they may best actuate the organs of the inner ear. For this purpose, a diminutive receiver is carried in the outer ear or located against the head immediately behind the ear, where it transmits the sound vibrations through the bony structure. The new device is said to be economical in operation, requiring less frequent replacement of batteries than previous designs, according to the manufacturer.

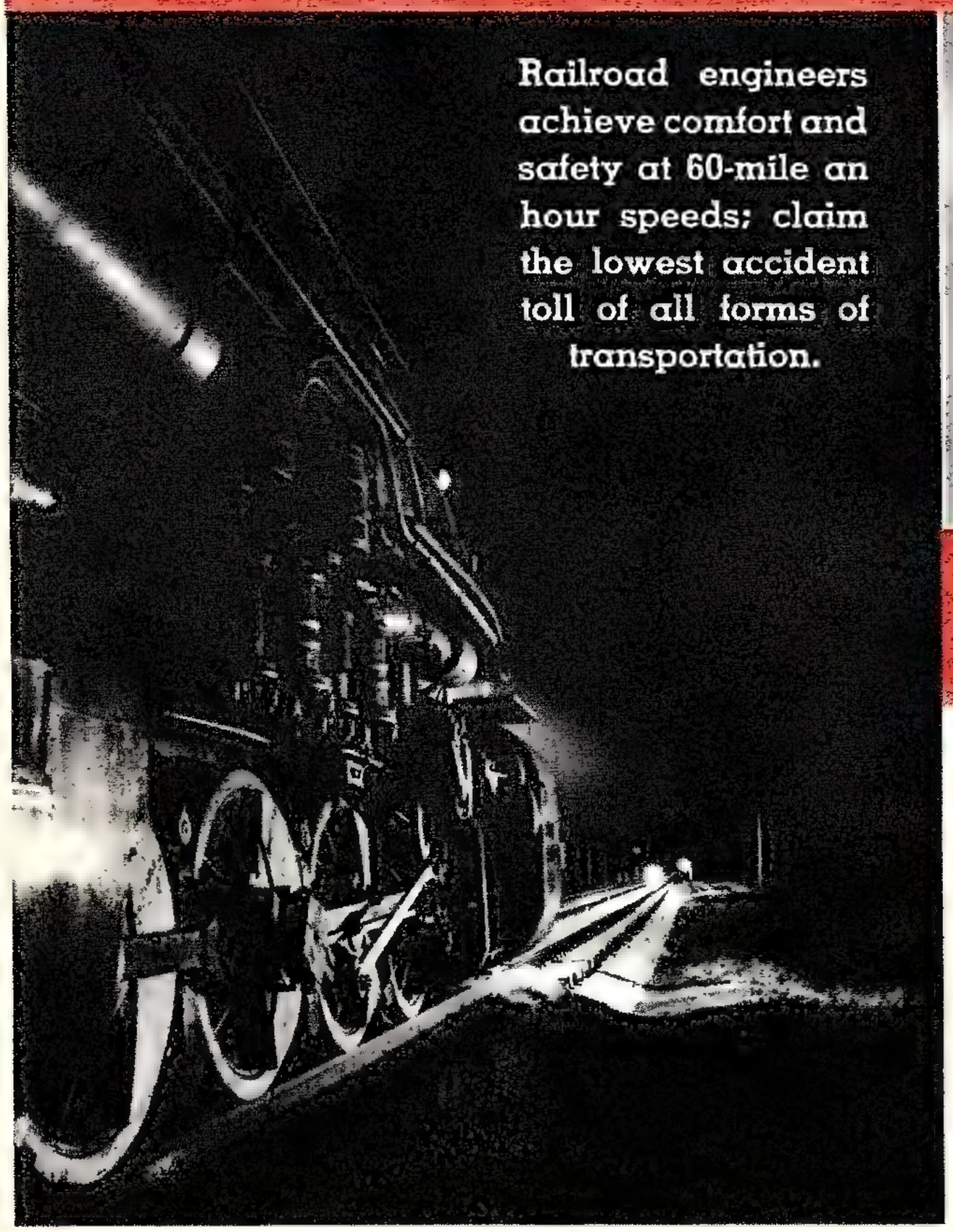


Machine Registers Votes Electrically

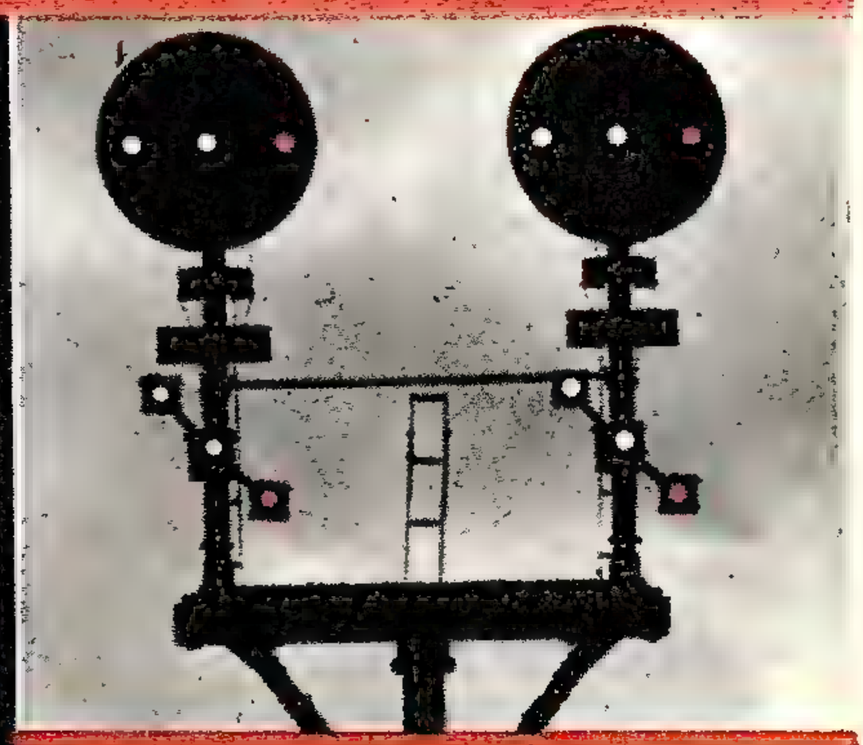
ELIMINATING the possibility of "stuffed" votes, a new voting machine employs a photo-electric cell to count ballots inserted in it. As each ballot is dropped in the box it intersects a light beam, causing a mechanical counter to register the ballot. No matter how many ballots might be stuffed into the machine at one time, it will register receipt of only one.



MILE-A-MINUTE



Railroad engineers achieve comfort and safety at 60-mile an hour speeds; claim the lowest accident toll of all forms of transportation.



An elaborate safety signal system visible day and night warns the engineer of possible traffic hazards along his route.

I'M SUPERSTITIOUS, see. It's Friday the 13th. I broke a mirror this morning, and the minute I stepped outdoors a black cat crossed my path.

Naturally, with things against me like that, I've got to play it safe. Do I go back and lock myself in the house? Do I tuck me away in my own little bed? Nothing of the sort! This jinx business is serious and I've got to get the percentage on my side. So I buy me a ticket on a nice fast railroad train.

If that sounds screwy to you, just look at accident figures for 1936:

	DEATHS
Accidents in the home	38,500
Automobile accidents	37,800
Public accidents (not due to autos)	20,000
Occupational accidents	18,000
Passengers killed, steam trains	23

So you see why I'm going to ride me a train. Perhaps I'll pick out one on the B. & O. Not a passenger has been killed on that line since 1919.

The greatest danger in the operation of all high speed vehicles is that of collision, and this danger the railroads have tackled from the earliest days. Now, with modern signal equipment, collisions are a rarity indeed.

Ride with me, if you will, in the locomotive cab of the New York Central's crack "Wolverine" from New York to Albany, and I'll show you how these signals work to prevent disaster.

Business is good today, the Friday before a week-end holiday—so good that the train must be run in three sections, as close together as safety will permit. We're with Engineer Simons, who has the third section. We're electric to Harmon, and steam the rest of the trip.

We leave Grand Central Terminal during the evening rush hour—a sixty-minute period during which 200 trains will use the 78 terminal tracks, and the four-track bottleneck tunnel under Park Avenue.

The first two sections have pulled out. We get a clear signal almost immediately, and start to follow. Our terminal track is at the

SAFETY

by Robert W. Gordon

extreme left of the upper level, and we are to take the inside right track through the tunnel, which means that we must thread our way diagonally across the entire maze of tracks. Levermen in the interlocking towers have set up that route for us, and the signals are all clear.

But a train coming down the outside left track is due to be spotted on one of the terminal tracks to the right. In the rush of work, the levermen in the tower forget about us and route that incoming train directly across our path.

Here is the stuff that collisions are made of!

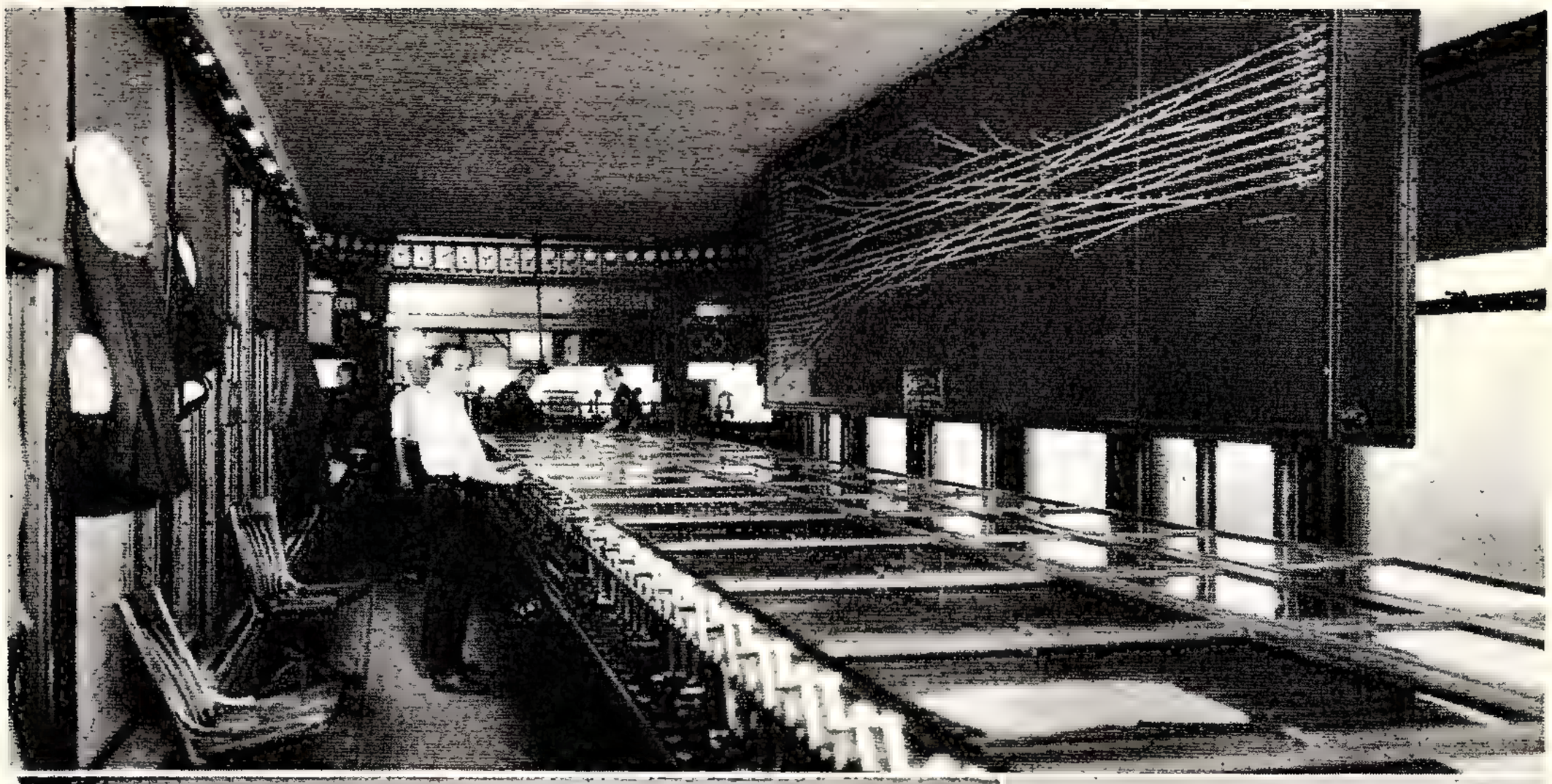
But nothing happens. That incoming train simply waits until we are clear. All switches and signals in the terminal are controlled through an interlocking plant, which makes it absolutely impossible to set up conflicting routes. A train cannot move until a clear route has been established. Once the route is set up, it must be cleared before other switches and signals crossing or touching that route can be changed. The element of human error has been completely eliminated.

But suppose something goes wrong mechanically? No machine is perfect.

The modern train is designed for comfort. The hostess on the Chicago, Rock Island and Pacific helps make the ride pleasant for passengers.

When something goes wrong with an interlocking machine, traffic simply stops. If a locking dog gets stuck, it still locks conflicting levers. If a switch doesn't close, it is impossible to set a clear signal across that switch. If a signal light burns out, so the indication cannot be read, engineers must consider it a danger signal and stop.

We're clear of the terminal now, and are running through the tunnel, which is gov-



Left—This shows the director's desk in the interlocking tower of the Washington, D. C. terminal. Dials above repeat signals in the yard outside. Above: Showing track control panel of the terminal.

erned by automatic block signals. These tunnel tracks are signalled both ways, meaning that trains can be run over them in either direction.

The director of the interlocking tower ahead of us at Mott Haven has two incoming trains to send into the terminal. He decides to route one of them down the track on which we are moving. He tries to move the traffic lever which will change the direction of the signals, but that lever won't budge until we have cleared the track, and without changing the direction of traffic with that lever, he cannot set the switch and signal levers that will put a train on our track. We couldn't have a head-on collision here, even if a signalman went berserk and tried to wreck us.

We change to a steam locomotive at Harmon. Soon it gets dark, but we continue to speed up the winding tracks along the Hudson at 70 miles an hour, about three miles behind the second section.

A mischievous boy with a .22 rifle decides to have a bit of target practice, so he shoots out the roundels of a semaphore signal after the first section has passed. The second section barges around a turn, and where a signal light should be, all is dark. The engineer immediately closes his throttle and releases the air. His train grinds to a stop.

We are right behind. Will we plow into him before the flagman can get back to wave us down with lantern and flares?

No, our engineer and fireman have been calling signals as they come into view. Now, instead of "High Green," which indicates a clear track, the fireman sees a yellow light over a red, and calls "Approach Medium."

"Approach Medium," the engineer repeats, and closes his throttle. He doesn't know the train ahead has stopped, but the signal has warned him that he is getting too close to it.

The next signal shows a yellow light over a red—the "approach" indication, meaning "be prepared to stop at the next signal." Long

Top—Overhead signals control movement of trains over a bewildering maze of tracks and switches. Above—Repairmen check the rails; insure safety.

before we round the turn and see the flagman's warning, we are running slow enough to stop within a few feet.

That warning we got three miles back was entirely automatic. A single volt from a storage or caustic soda battery flows through the track continuously when that track is clear, but when a train enters the block, the circuit is shorted. The magnetic latch, which has been holding the semaphore in the vertical position, lets go, and the signal behind the train falls to the "stop" position. Sensitive relays then change the two signals behind to the proper cautionary indications.

We have a three-block semaphore system here. Other roads might use a one or two-block system, depending upon individual traffic requirements. Or color lights, position lights, or color position lights might be used instead of semaphores, but the principle of action is the same—the track carries a current of small voltage. When anything—a train, a broken rail, a mechanical failure, interrupts that circuit, the signals say "Stop," or say nothing at all, which means the same thing.

But suppose that our engineer and fireman both missed that first danger signal. Through magnetic induction, a relay is opened in the cab and a warning whistle is blown. The engineer then has fifteen seconds in which to press the acknowledging lever and begin slowing his train. If he doesn't act within that time, the brakes are automatically applied.

All railroads do not have this automatic train control, while some have indicators in the cab which repeat the wayside signals. Density of traffic is usually the factor governing such installations; block signals, interlocking, and automatic train control being obviously unnecessary on branch lines carrying but one train a day.

But you could always run off the road!

Certainly. And trains occasionally are derailed. But though railroad schedules have

After every run, the engineer inspects his engine carefully, oils and tightens all major parts (left). Journal inspections are routine "musts" (above).

been speeded up 42 per cent in the past twelve years, derailments have been reduced 64 per cent.

Better ballasting, the scientific banking of curves, the higher quality of steel in the heavier rails, have all played their part. But the greatest factor in reducing derailments is the constant inspection with the Sperry Detector Car.

Traveling slowly over the line, the car passes a low voltage current through each rail, setting up a magnetic field around each rail head. Any internal defect in the rail causes this field to be distorted. A recording device notes this defect, and the rail is automatically sprayed with white paint. Defective rails are immediately replaced with sound ones. The result is that broken rails have been almost eliminated as a cause of accidents.

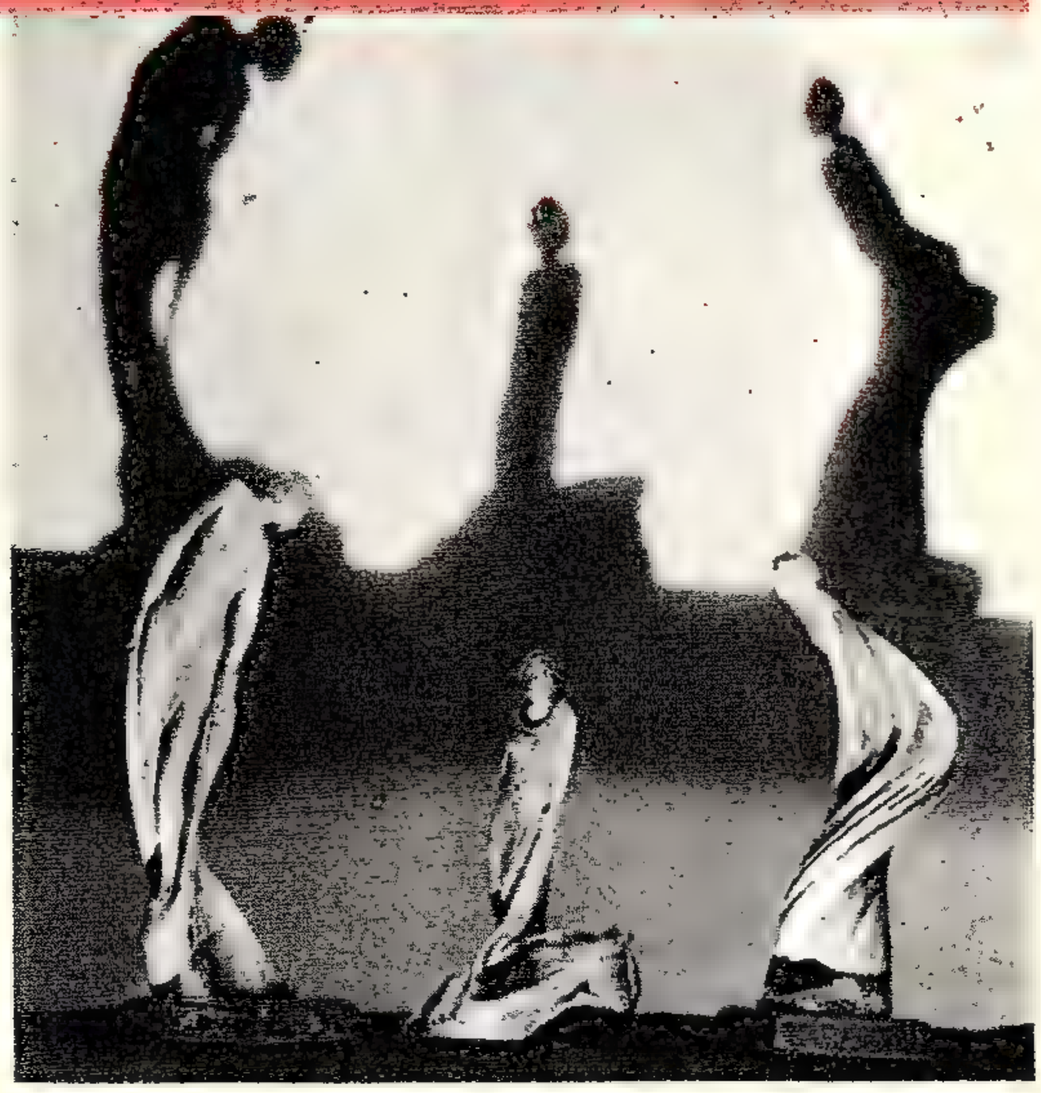
Nibbling away at the accident toll are such things as all-steel cars, enclosed vestibules, bumper plates, and bellows, which prevent passengers from falling between cars.

Grade crossings are protected by special lighting as shown at this Missouri-Kansas-Texas railroad crossing.

RANCHER SCULPTURES ROOTS AS HOBBY

USING the gnarled and twisted roots of juniper shrubs as his medium, W. G. Hodgson, a rancher in Alberta, Canada, has attracted the attention of the artistic world by his ability to sculpture figurines which, by their perfection, express the countless moods of different human types. Strangely enough, the beautiful figurines are sculptured with carving implements made from salvaged parts of old automobile magnetos.

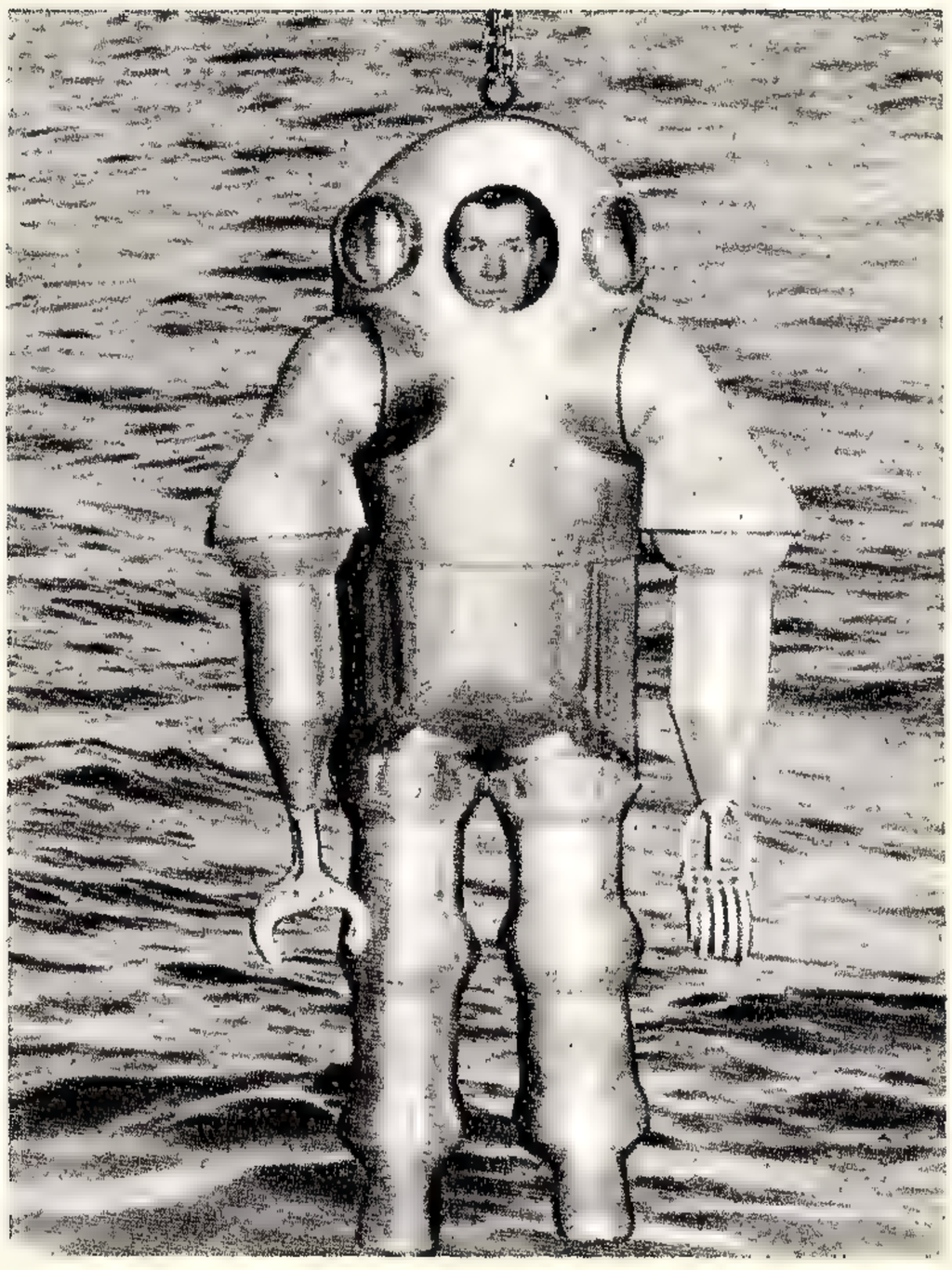
Whereas in ordinary sculpturing, the artist carves or chisels an object according to a preconceived idea, in sculpturing the roots the rancher-artist is necessarily limited by their curious twists and turns. Yet, so vast is the variety of the roots that he has instilled in his figurines, the expressions of agony, sorrow, age, youth, etc. Groups of the figurines have been exhibited in the art centers of New York, Paris and London and are said to have stirred critics to loud enthusiasm.



Sculptured from twisted juniper shrub roots, the artistic figurines shown in the two photos above express, in their line of face and turn of body, a wide variety of human moods.

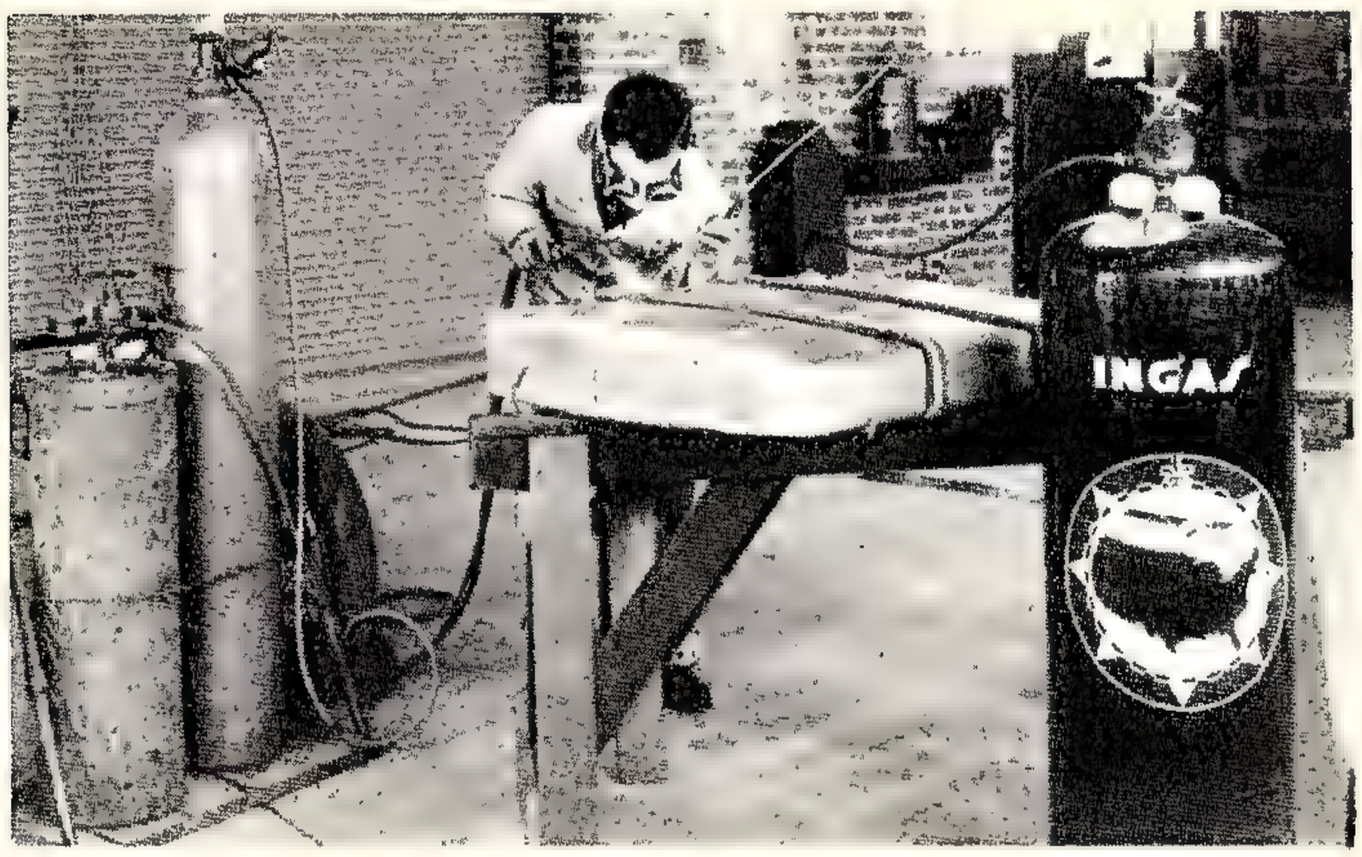
"Turtle-Back" Cockpit Speeds Handling Of Machine Gun

A SPECIALLY designed "turtle-back" rear cockpit hood, which enables a machine gunner to uncover and swing his weapon into action in a few seconds (above), is an outstanding feature of a new Air Corps amphibian military plane, claimed to be the fastest in the world. The hood is unfastened by means of a simple catch-lock upon which it instantly slides into an out of the way position.



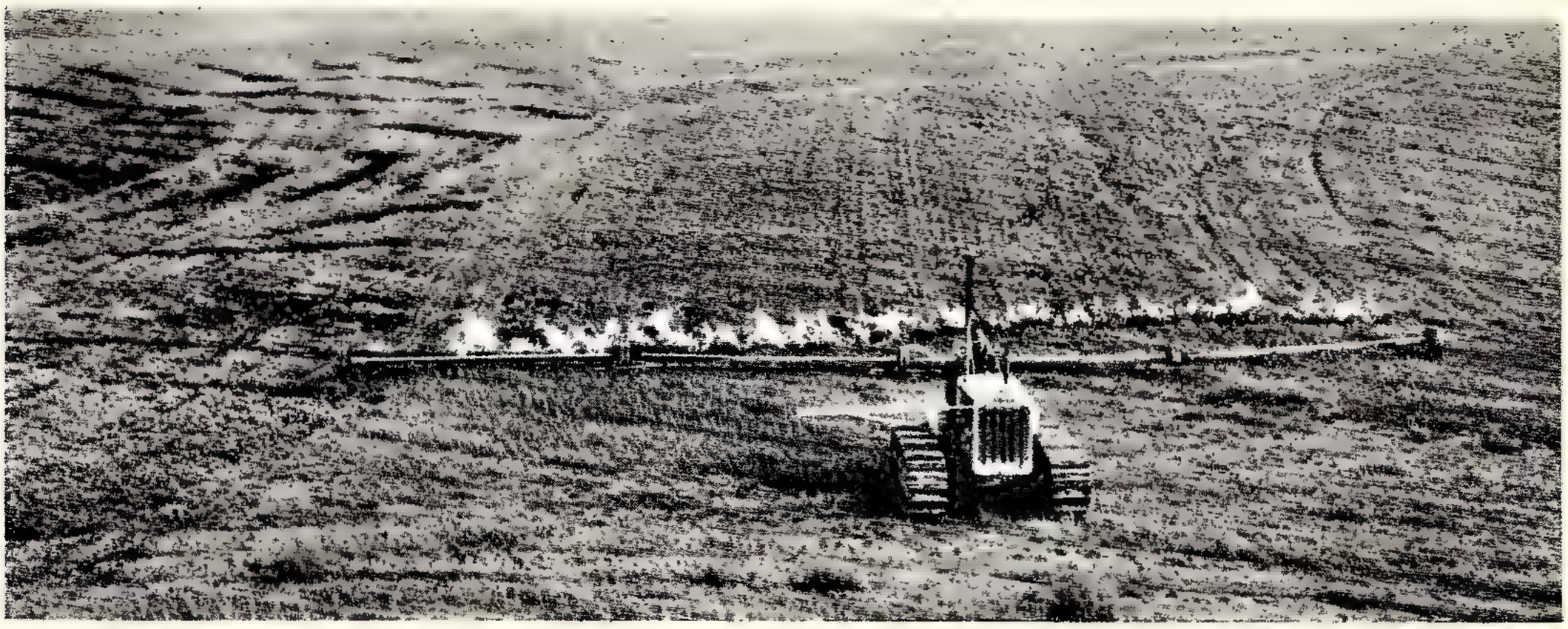
Metal Diving Suit Developed

FITTED with ball bearing knuckle joints, which provide mobility for the wearer, a new all-metal diving suit is said to enable a diver to descend to a depth of 1,200 feet. The suit eliminates the need for air lines, having a specially designed built-in air tank. Hand-operated grappling irons are a feature of the suit.



Inert Gas Protects Fuel Tank Welder

COMPRESSED in storage tanks from which it can be withdrawn as needed, a non-toxic inert gas composed of 13% carbon dioxide and 87% nitrogen provides a protective blanket over gasoline in auto and airplane tanks, enabling punctures in the tanks to be welded without fear of an explosion caused by the torch.



Farmer Devises Novel Way To Remove Weeds

AN INTERESTING method of ridding land of weeds before summer fallow plowing has been credited to Elmo Irwin, of Ritzville, Wash. Hitching an 85-foot harrow behind his tractor, Irwin sets fire to the trash it gathers up as the tractor moves across a field, clearing about 25 acres of land per hour.

Special Tires Assist Tractor

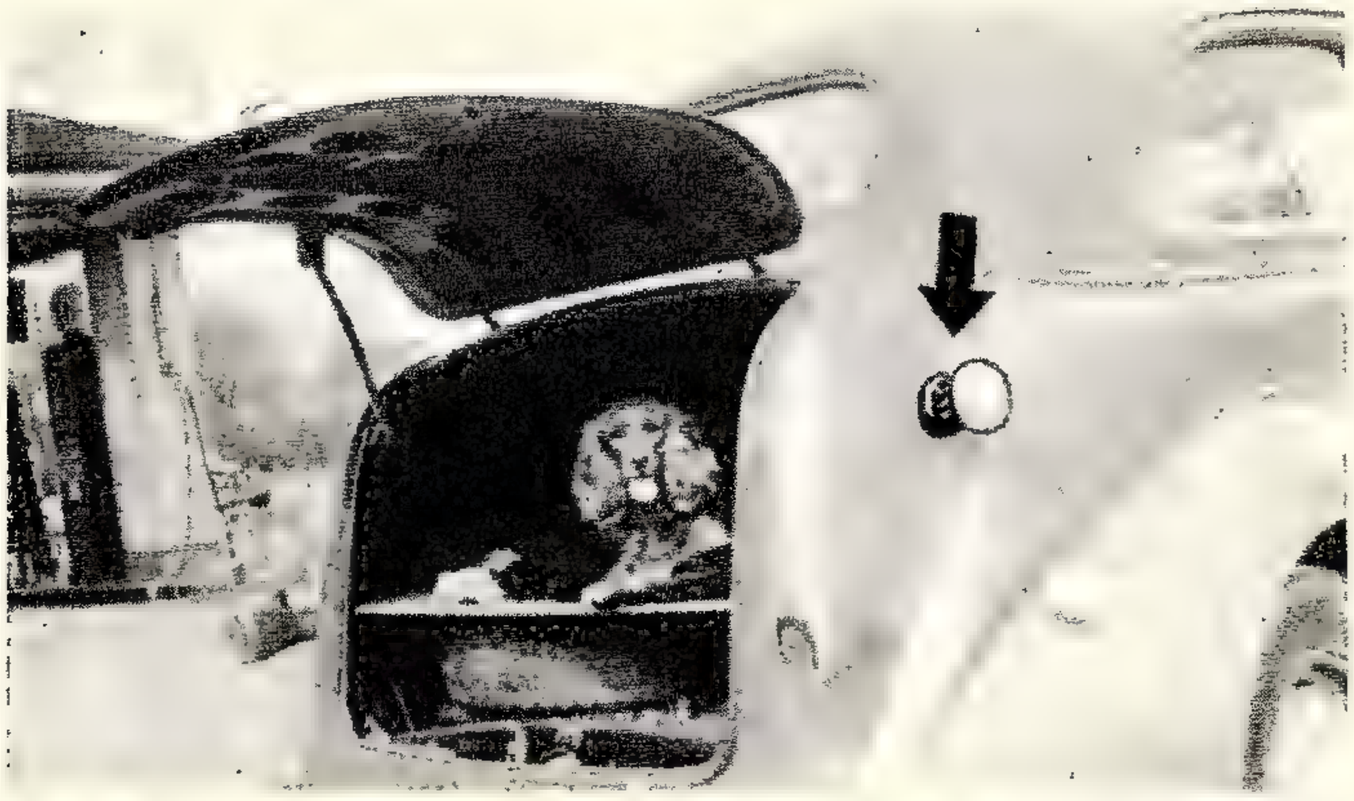
EASIER and more accurate turning as well as maximum traction with a resultant lowering of fuel consumption is claimed for tractors equipped with newly developed front and rear wheel pneumatic tires. The front tires feature a non-skid "ring" while the rear tires are fitted with extra high cleats.

Restaurant Novelty Amuses Patrons

DINERS seated at a certain table in a downtown New York, N. Y., restaurant are amused to find their knives spinning around like compass needles or sticking to the forks as though magnetized. The "secret" is the magnetic influence of a powerful dynamo in the plant of an electric supply company located next door.

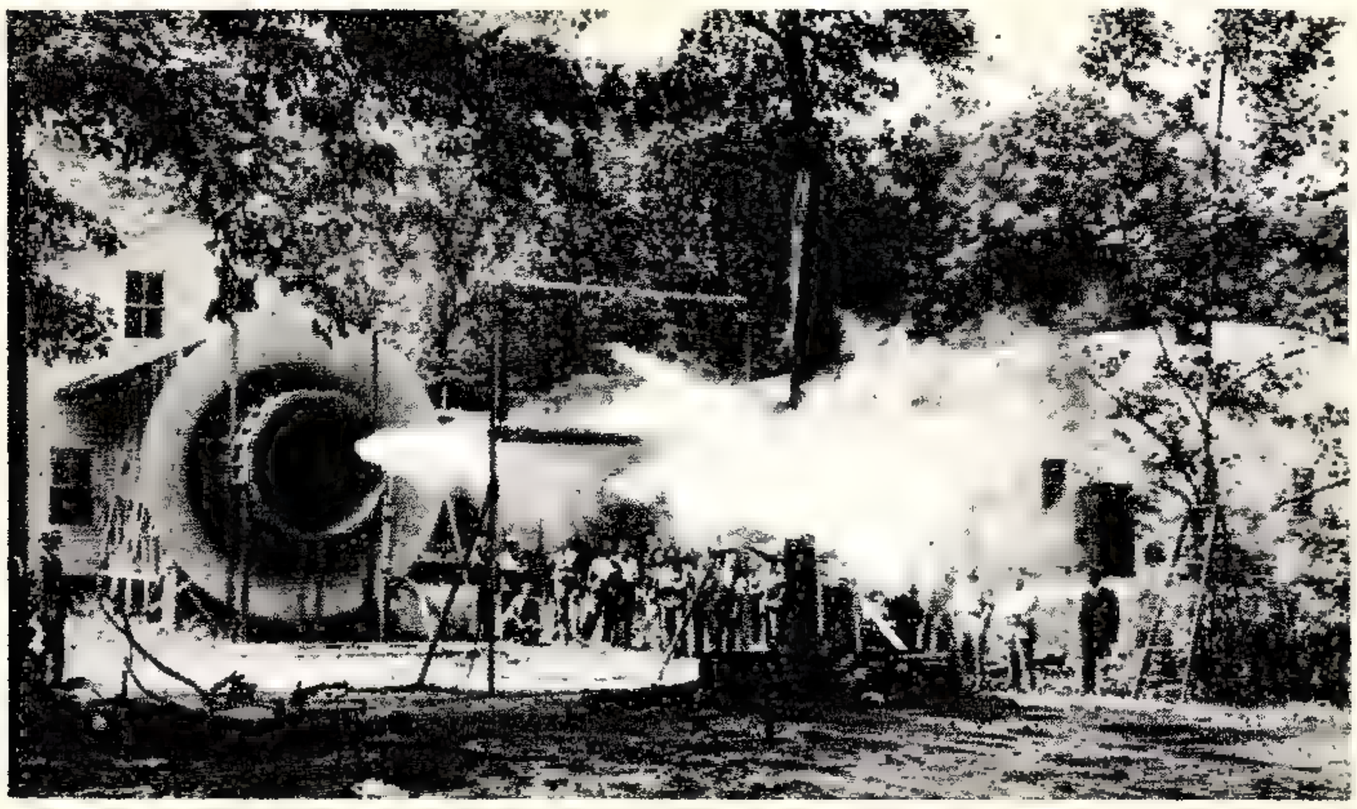
Plowing Machine Creates "Dams" To Hold Rainfall

DEVELOPED by C. T. Peacock, a Colorado farmer, a new "chisel-shovel" machine is said to provide a means of plowing a field in such a manner that rainfall can be accumulated, assuring moisture for the topsoil during dry spells. The machine plows the soil with specially designed blades which pack the dirt at intervals along the furrows, turning them into scores of miniature dams which store rain, as shown above.



Ventilator Makes Auto Trunk "Home" For Pet

FITTED into the side of an automobile trunk, a new ventilator device (arrow) enables dogs or other pets to be carried in the compartment in perfect comfort. The vents of the ventilator are adjustable, enabling the amount of air entering the trunk to be regulated according to prevailing weather conditions.



Seek Aero Fire Data

USING a wind tunnel to blow flaming gasoline past an airplane wing suspended on poles, U. S. Bureau of Standards engineers are conducting tests to determine whether the blast from an airplane's propeller would blow the flames clear of the plane if gasoline was accidentally ignited while being released from a fuselage dump valve during a flight.

Flies 2,000 Feet In Hang-Type Glider

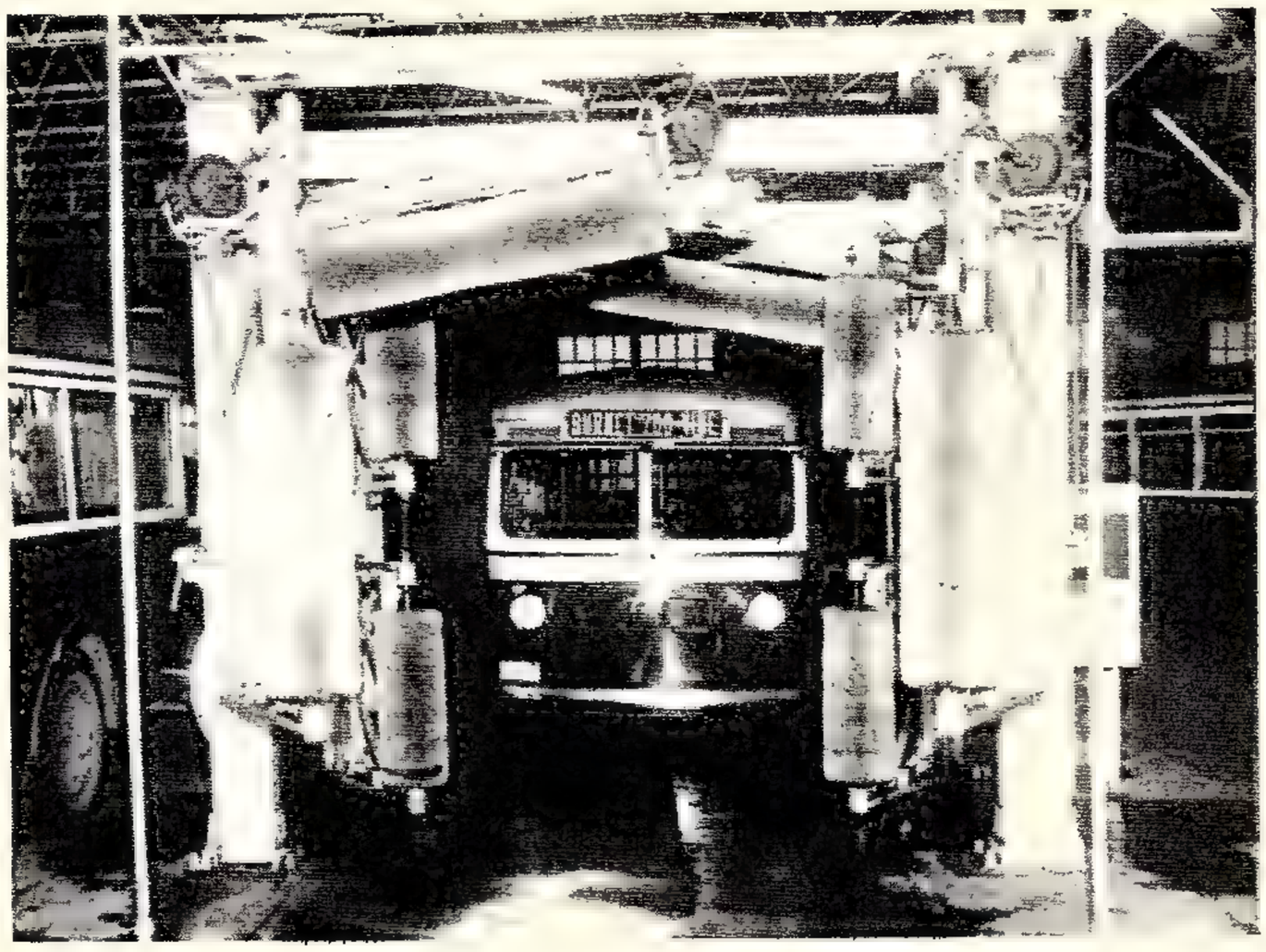
FLYING a home-built hang-glider of his own design, Bob Morse, of Los Angeles, Calif., claims to have made a flight of 2,000 feet during which the glider attained a height of more than 100 feet. The novel glider's frame is mounted on a single wheel and launching is accomplished by running downhill against the wind. Morse pilots his glider by movements of his body, to which the various flight control cables are strapped.

Youth Claims Discovery Of Artificial Radium

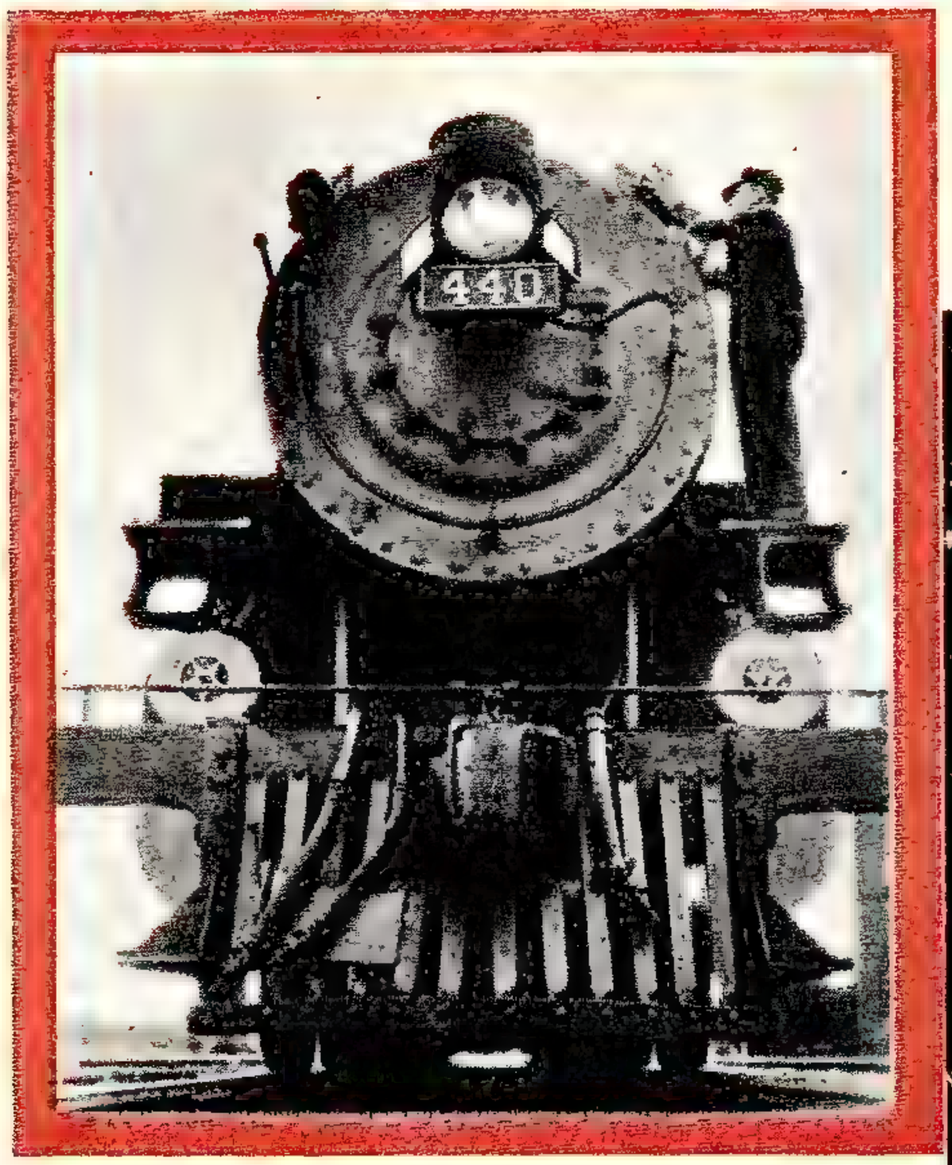
STARTLING the scientific world, Wallace Louis Minto, Jr., 16-year-old high school senior of Jersey City, N. J., claims that he has discovered a method of making artificial radium and other radio-active minerals from ores obtainable in New Jersey and adjacent states. The young experimenter has been invited to explain his home laboratory discovery at a convention of medical doctors and radio-therapists. The high school youth believes he can produce the artificial radium at a cost of $250 per gram as against the price of $25,000 per gram for real radium.

"Laundry" Washes Bus In One Minute

INSTALLED in the garage of a transportation company in Cincinnati, Ohio, a new automatically operated machine washes a bus in 60 seconds. The device is controlled by an "electric eye," the blinking of the bus' headlights setting water sprays and revolving brushes in motion. The brushes are articulated to permit use on non-vertical surfaces.



$50.00 For One Picture!



CAMERA owners: here is your chance to make your hobby earn money for you! MECHANIX ILLUSTRATED is in the market for colorful, human-interest photographs of people or machines at work —in the shop, in the laboratory or in the field. For pictures selected by the editors for reproduction on the front cover, the flat price of $50.00 will be paid. This is a high figure for a single photograph, and will enable the winner to buy a new enlarger, another lens, or some other long-desired accessory.

There is practically no limit as to subject matter within the mechanical, industrial, scientific fields. You may find good subjects in your own home or in the office or factory in which you work, or you may encounter them accidentally while traveling by train, plane, car or boat. Keep your eyes open and your camera ready, and don't hesitate to shoot every scene that looks attractive.

The ideal cover picture is hard to describe, but in a general way it should show a single, strong object against a plain background. Three pictures are shown on this page as suggestions for cover subjects. They are effective because they fill the eye without distracting it. Photographs containing a human figure are preferred. Avoid "pretty" pictures of scenery

[*Continued on page* 137]

Machine Analyzes Air "Breathed" By Bridge

TO DETERMINE the paint-destroying components of the air "breathed" by the San Francisco-Oakland Bay Bridge, engineers of the California Division of Highways constructed a wind-operated analyzer device which collects samples of the air in a bottle of distilled water. Initial experiments revealed that the span "breathes" an atmosphere including sulphates, salt, coffee, chaff and soot.

Mask Protects Worker Against Silicosis

DEMONSTRATING the efficiency of a newly developed mask for mine workers, which is said to provide 100% protection against silicosis (inhalation of silicate dust), the laboratory worker shown in the photo at right remained in a sealed test chamber for 30 minutes while a spray gun blew carbon black directly against his mask. To simulate physical working conditions, he pedaled a specially mounted bicycle.

Builds Summer Home Around Tree Trunk

POSSESSING a plot of ground on which he desired to build a summer home, but not wanting to cut down a tall tree occupying the spot, a property owner in Los Angeles, Calif., solved the problem by building the house around the tree. The house features a large single room and an overhead rustic-type pavilion, as shown in photo.

Can Amateur Flying

Above left: 1935 Oregon altitude winner, 11,000 ft. in 27 minutes; 40 h.p. engine. Built by Elmer Smith. Above right: Heath monoplane, 40 h.p. engine, 107 m.p.h., built by Sterling Barnes. Right: Three planes constructed by Oregon flying club members.

WHETHER or not amateur flying can come back depends on what the friends of flying will do for it in their home states. Although American military and commercial aviation are constantly reaching new heights, the plight of the amateur flyer steadily becomes worse. At the present time, it is practically impossible for the "little fellow," the chap who builds and pilots his own ship, to get into the flying game. Absurd state and Federal legislation has so modified and hampered the home-builder that unless something is done very soon, amateur aviation will be as dead as the proverbial duck.

The one outstanding exception to this situation is the state of Oregon. Convinced that the amateur has certain rights and liberties, this state has aviation legislation which might well be copied by the rest of the states of the Union where restrictive measures exist.

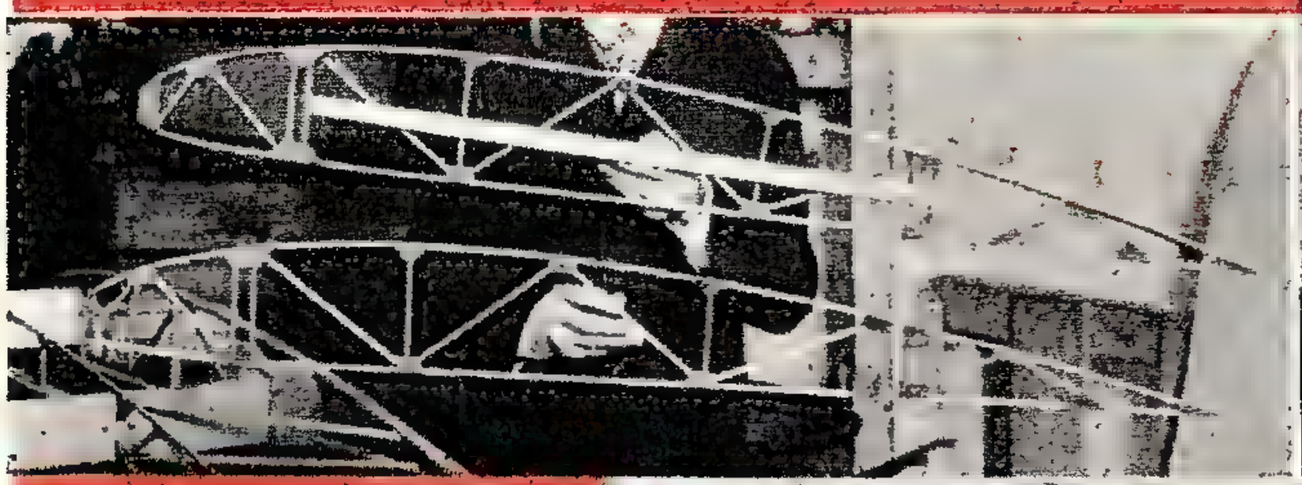
Much of the success of amateur activity in Oregon is due to an organization of amateur builders and pilots known as the Private Flyers Association. The champion of the "little fellow," this organization was formed in 1935 for the "advancement of unrestricted private flying, experimentation, and aviation in general." Almost every person in Oregon interested in amateur flying is a member, as are numbers of home-builders in various other states. Such an association provides for concerted action on any measure and its will cannot be easily disregarded. In event oppressive legislation threatens the amateur, this organization gets busy and sufficient pressure is brought to bear to the end that the state is a haven for amateur plane builders. The membership dues in the Private Flyers Association are not high and a special legal fund is maintained by voluntary contribution to combat adverse legislation.

Realizing that there must be a definite program if amateur activities are to be kept unrestricted, the Private Flyers Association has drawn up a practical code as follows:

1. Appointment, by the governor, of a board of five members, all of them actively interested in aviation, and at least two of them private owner-pilots. Board members to serve five years with a new member being appointed each year. One member to be selected as state aeronautic inspector, to be charged with licensing and registration of aircraft. All members to serve without pay, except for expenses.

2. All students and pilots in the state to be licensed by either the Department of

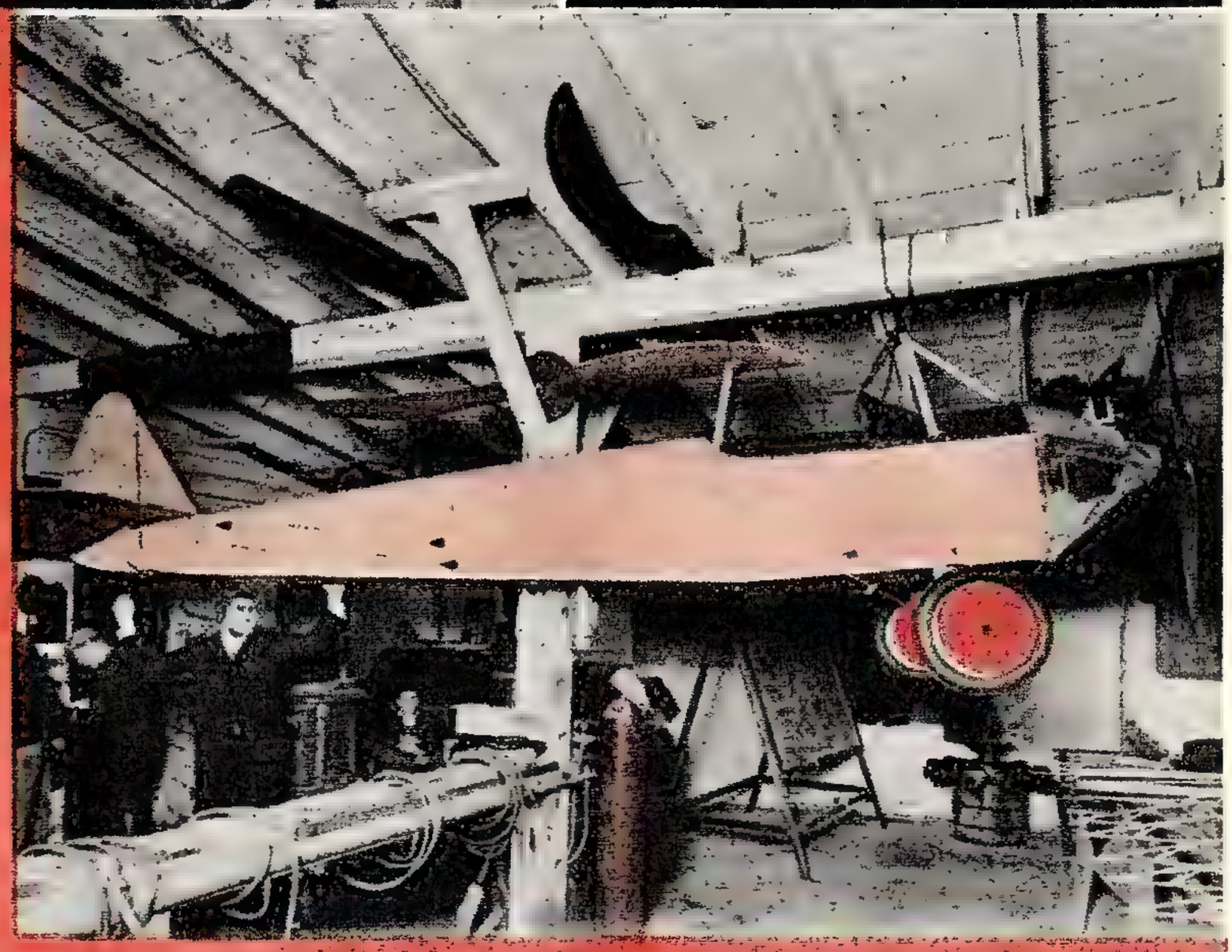
Come Back?



Above: Heath monoplane built by Walt Rupert. Left: Wing ribs are carefully inspected. Below: Partially assembled plane.

by Lt. R. H. Rankin

Amateur flying never left Oregon, where it flourished under favorable state laws. States with restrictive laws should go West to see how it is done. Amateurs interested in promoting favorable flying laws in their states should write to the editors for information.



Commerce or the state, the state license fee to be $3 for the year and the state requirements to be modeled on the Department of Commerce regulations, *save for physical requirements.*

3. All aircraft to be registered with the state board. Planes may be either Department of Commerce licensed or, in case of identified aircraft, licensed by the state after being found airworthy. License fee for identified planes to be $5 per year.

4. Aircraft licensed by the state must pass an examination by a licensed airplane mechanic as to general mechanical condition, the charge for this examination to be set by the examining mechanic.

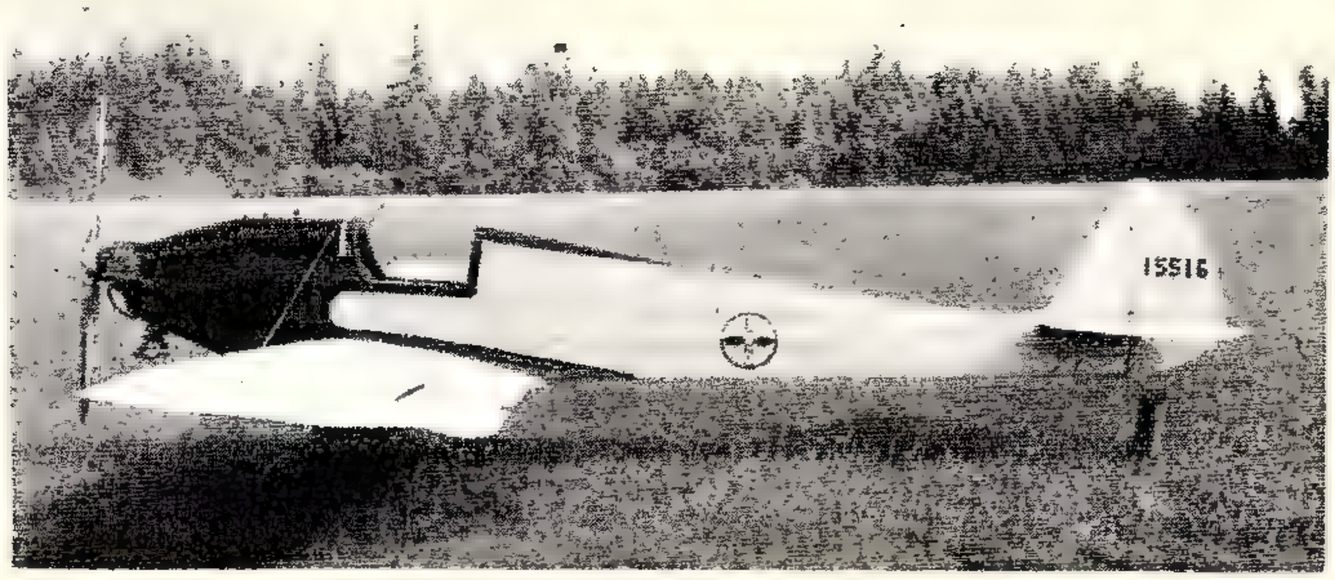
5. State-licensed aircraft to be used for sport, pleasure, or experimental flying only. Commercial flying to be forbidden in such craft.

6. Enforcement of the provisions of the state code to be in the hands of the state police and expenses of the aeronautical board to be borne by the state traffic department.

7. Violation of state laws to be punishable by a fine of not less than $50, nor more than $500, or imprisonment of not less than 10 days, nor more than one year.

Airplanes must be inspected during construction and upon completion and if they pass flight tests to the satisfaction of state inspectors, they are licensed. A $10 fee is charged for the license and $5 for a pilot's ticket of which there are two grades: Private and Student. In addition to these licenses, a special solo ticket is issued on presentation of an affidavit indicating that the applicant has had at least five hours of solo flying. So safe has this regulation worked that in 17 years that the Oregon board has

Right: Harold Briggs built this ship—best of its class in Oregon. Below: Low wing monoplane designed by Les Long, light plane designer par excellence. Bottom: Victor Lindahl is proud of this seaplane which he built.



functioned, there has been only one fatality.

The average age of the members of the Private Flyers Association is twenty-eight, with ages varying from 17 to 68. Seventy per cent of the members are active members, i. e., owners or pilots of some type of aircraft. Some are transport or limited commercial pilots who are not connected with any commercial operations. All other members are amateurs, students, or private pilots. All walks of life are represented from farmers to college professors. The members building their own planes are, for the most part, mechanics, welders, and electricians. However, there are many farmers, truck drivers, service station operators, and high school students who build their own craft. It takes the average amateur about two years to complete his ship.

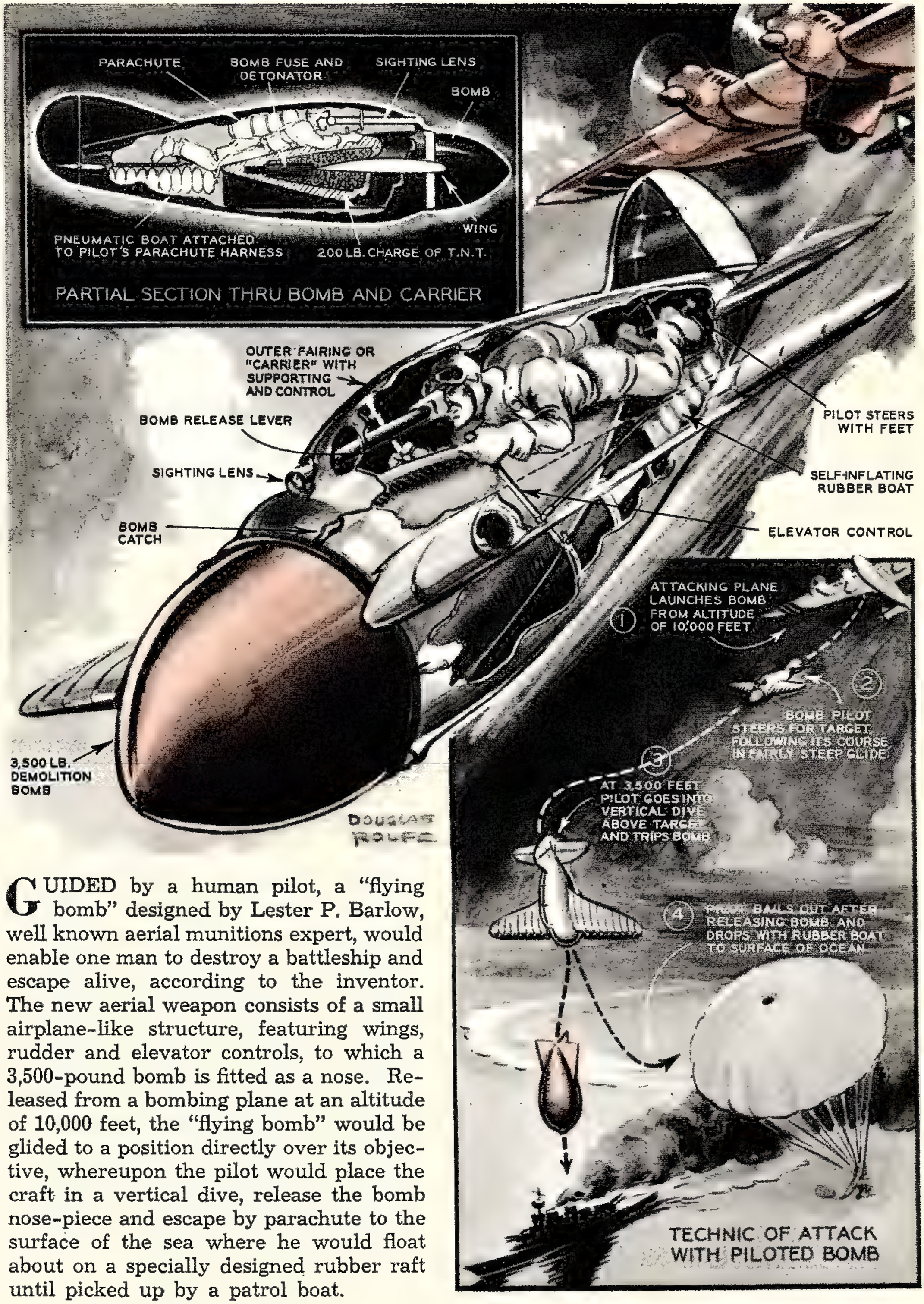
The cost of the amateur ships is very low. Many planes are being built by members of the Private Flyers Association for less than $700. All these craft have been flying for hundreds of hours and have demonstrated their worth fully. One small ship was built for $100, plus labor, and was flown for three years before it was finally washed out by its pilot trying to climb it too steeply. Nothing was damaged much, however, and the engine is still being used and at the present writing has at least been in use for five years. Of course, this little ship was an exception. The majority of ships average from $350 to $500 for materials, depending upon the type of engine used. The horse-power of engines used ranges from 20 to 165, with the average being between 40 h.p. and 110 h.p.

It is easy to realize that all amateur airplane builders and flyers watch with intense interest through long months while another home-builder's plane is under construction. Long before the test flight, Association members engage in fast and furious arguments about the good and bad points of the particular job.

Everyone who can, turns out for the test flight and comments are many and varied as the sweating owner labors in getting the bus ready for flight. Gas and oil is checked. All controls are inspected and wings and landing gear are gone over. The engine is started and the amateurs listen as it is "revved up." The owner checks the oil pressure and notes the engine temperature for the last time and everything is ready for the hop. If the owner is not test flying the ship, the official Private Flyers Association test pilot or one of the more expert Association pilots gets into the cockpit. It is taxied out to the runway, headed into the wind and gunned for the take-off. The plane usually lifts after a short run inasmuch as the majority of home-built craft have a fairly light wing loading. After being flown for about fifteen minutes, the plane is brought in and the assembled amateurs swamp the pilot with questions as to the ship's performance. Then, several pilots

[*Continued on page* 146]

"Flying Bomb" Guided by Man Pilot


PARACHUTE
BOMB FUSE AND DETONATOR
SIGHTING LENS
BOMB
WING
PNEUMATIC BOAT ATTACHED TO PILOT'S PARACHUTE HARNESS
200 LB. CHARGE OF T.N.T.
PARTIAL SECTION THRU BOMB AND CARRIER
OUTER FAIRING OR "CARRIER" WITH SUPPORTING AND CONTROL
BOMB RELEASE LEVER
SIGHTING LENS
BOMB CATCH
3,500 LB. DEMOLITION BOMB
PILOT STEERS WITH FEET
SELF-INFLATING RUBBER BOAT
ELEVATOR CONTROL
DOUGLAS ROLFE
1 ATTACKING PLANE LAUNCHES BOMB FROM ALTITUDE OF 10,000 FEET
2 BOMB PILOT STEERS FOR TARGET, FOLLOWING ITS COURSE IN FAIRLY STEEP GLIDE
3 AT 3,500 FEET PILOT GOES INTO VERTICAL DIVE ABOVE TARGET AND TRIPS BOMB
4 PILOT BAILS OUT AFTER RELEASING BOMB AND DROPS WITH RUBBER BOAT TO SURFACE OF OCEAN
TECHNIC OF ATTACK WITH PILOTED BOMB

GUIDED by a human pilot, a "flying bomb" designed by Lester P. Barlow, well known aerial munitions expert, would enable one man to destroy a battleship and escape alive, according to the inventor. The new aerial weapon consists of a small airplane-like structure, featuring wings, rudder and elevator controls, to which a 3,500-pound bomb is fitted as a nose. Released from a bombing plane at an altitude of 10,000 feet, the "flying bomb" would be glided to a position directly over its objective, whereupon the pilot would place the craft in a vertical dive, release the bomb nose-piece and escape by parachute to the surface of the sea where he would float about on a specially designed rubber raft until picked up by a patrol boat.

Nature Photography Around The Year

by Percy A. Morris

Milkweed blossoms photograph well at 1/10 sec. at f.16 on ortho film with fair sun.

MID-SUMMER is apt to be one of the busiest seasons of the nature photographer's year. Flowers are in abundance. Insects are fast attaining the peak of their abundance, and young, half-grown birds, not nearly as shy as their parents, may be seen in every orchard. In fact, in mid-summer it is not so much a question of "what to take" as "what not to take."

When photographing plants, a common difficulty is due to the fact that flowers sway in the slightest breeze, and since flower photography sometimes means time exposures, the photographer has to take advantage of the rare, and usually quite, brief periods during which the plants are not set in motion by the wind. Such periods are more likely to occur during the early morning than at any other time. If the plant is covered with dew, shake it, and then wait several minutes for the various parts to get back into place.

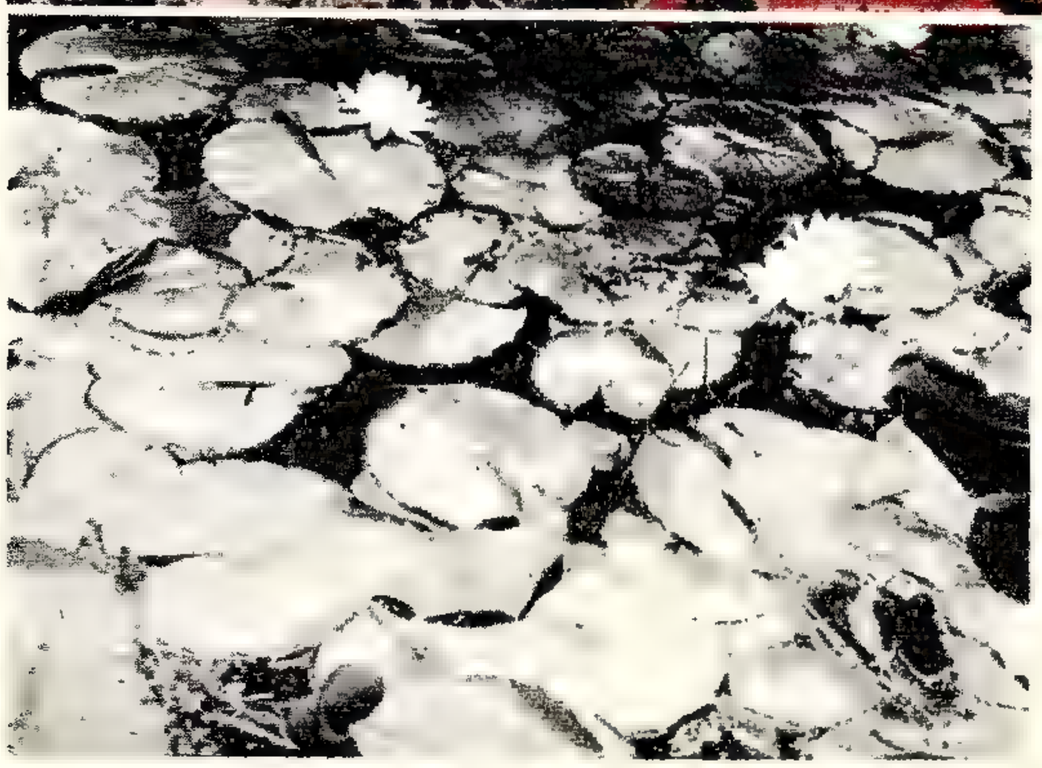
Many successful workers use the "split-exposure" method. The camera is firmly attached to a tripod and critically focused on the flower. The lens is stopped down to its smallest opening, and the shutter set on "bulb." The photographer then waits patiently for a brief interval when the plant is motionless. The shutter is then opened, and closed the instant the plant starts to move. If the exposure time is not deemed sufficient, the photographer merely waits for the next calm moment and opens the shutter again, repeating the procedure perhaps two or three times, until his film has had the proper amount of exposure.

In making a collection of photographs of flowering plants, don't lose sight of the fact that the blossoms are followed by the fruit, in the form either of berries or of seed-pods. Pictures of this phase of plant life are needed if a series is to be made, especially if you are photographing plants from a botanical standpoint.

Snakes make excellent photographic subjects. The snake is a natural-born "poser." When freshly discovered, its first effort is to escape, but if its retreat is cut off, it will invariably assume an attitude of watchful waiting and will "freeze" in this position, holding it for several minutes without so

Ribbon snake. Easy to photograph, beautiful to look at!

Garter snake. Try this in a bright sun at ½ sec. at f.22.



Pond lilies. Bright sun, 1/50 sec. at f.11 on ortho film.

much as a quiver, except for the darting tongue. This permits the photographer to stop down to the smallest aperture to ensure depths of focus, put on a filter, and expose for several seconds if necessary.

There is much to commend the snakes to the nature-lover-with-a-camera. The infinite variety of postures they are capable of getting into, all of them perfectly natural and pleasing to the eye; the beautiful iridescent colors of some species, and the fact that a good series of snake negatives are not common.

By far the majority of snakes may be photographed without danger. Some of them will bite if handled, but so will almost any wild creature, such as a squirrel, and of the two the squirrel will give you much the worse nip. It is usually easy to maneuver a snake into position for a photograph without touching it, unless it be with a stick.

A photographer working alone should never attempt to photograph a copperhead or rattlesnake. If two are working together, there is no particular danger, as one can watch the snake while the other is adjusting the diaphragm, setting the shutter, etc. The solitary photographer would have to take his eyes off the snake, and this is dangerous.

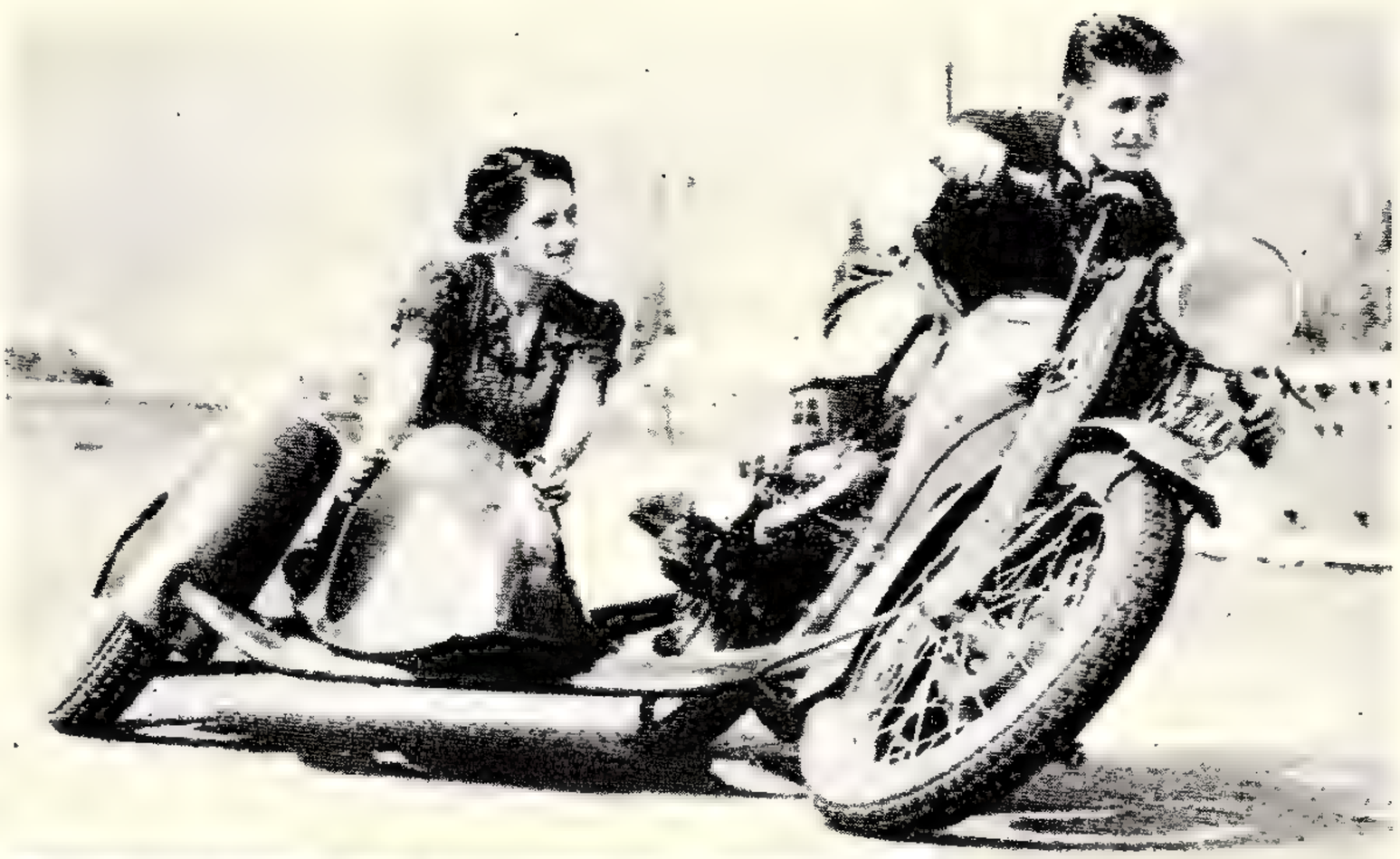
MI'S "BOOK OF THE MONTH"

Every month several meritorious books are published which the editors believe are of special interest to readers of MECHANIX ILLUSTRATED. We know, of course, that you may not be able to read them all, and for that reason we plan to select the outstanding book of the month and present here an extract from it. The books will be chosen for their special interest in the fields of adventure, travel, sports, science, mechanics and history. The episodes selected will be of some complete dramatic, informative incident.

Readers who wish to obtain these books to be read in their entirety may order them from local book dealers or by mail from the publishers. Every volume from which we will select an extract will form a lasting, worthwhile addition to your library.

"Nature Photography Around the Year" by Percy A. Morris, is our selection for August. The publisher is D. Appleton-Century Co., 35 W. 32 St., New York, N. Y. Price is $4.00.

New Motorcycle Sidecar Mounting Speeds Turns



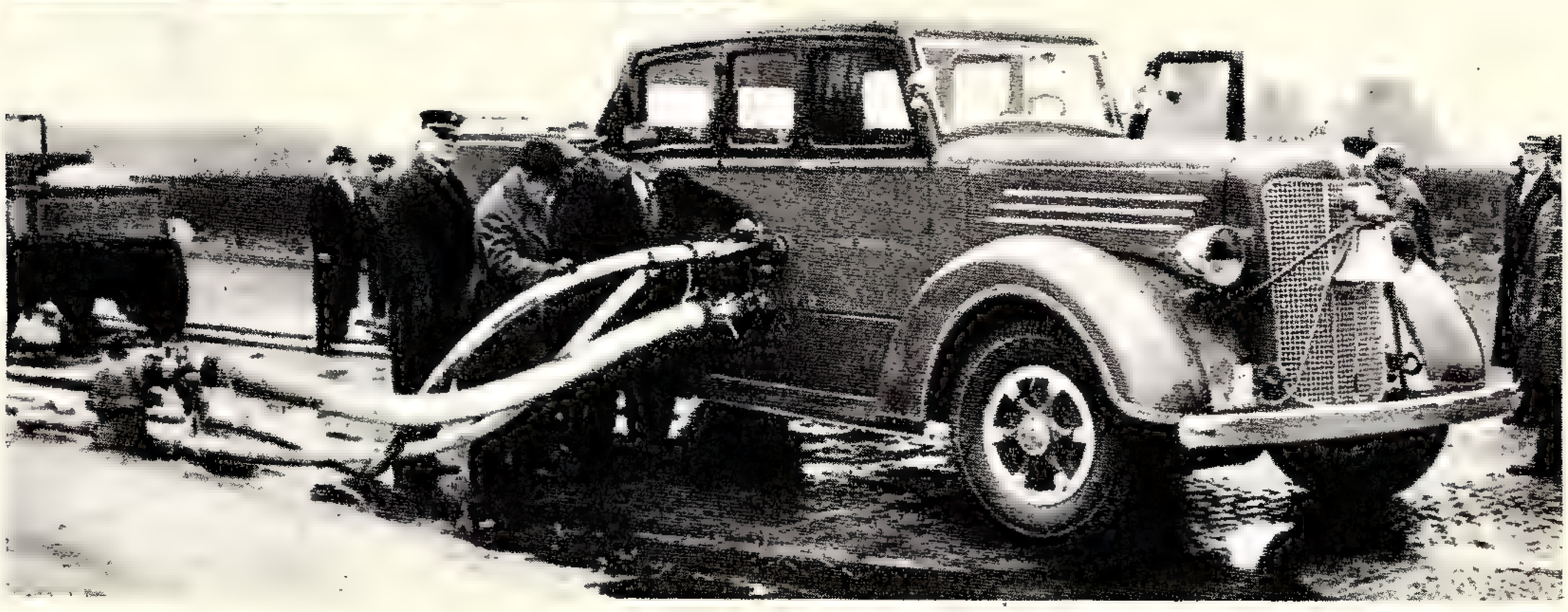
THIS unusual sidecar makes possible considerably greater speeds than have been possible in the past. The usual type of mounting carries with it danger of tipping over when the machine is turned at high speeds. With this device, the sidecar wheel as well as the motorcycle itself can lean as far as necessary.

Hand Tool Gives 5-Ton Force

LESS than seven inches in length, this tiny handpower tool exerts pressures up to 10,000 pounds for cutting bolts, rivets and nuts. It provides a mechanic with a small heavy-duty tool which can be carried in the tool kit. It can be operated by an ordinary wrench or the ratchet type when necessary.

Fire Truck Goes Streamline

A FAR cry from the old puffing horse-drawn fire engine, with fire laddies on open seats and hanging from the steps, is this stream-lined fire truck put into use in Chicago. The enclosed cab carries eight men in comfortable seats. The powerful pumps are located under the cab. In the rear is space for carrying other necessities for fighting fires, particularly hose.

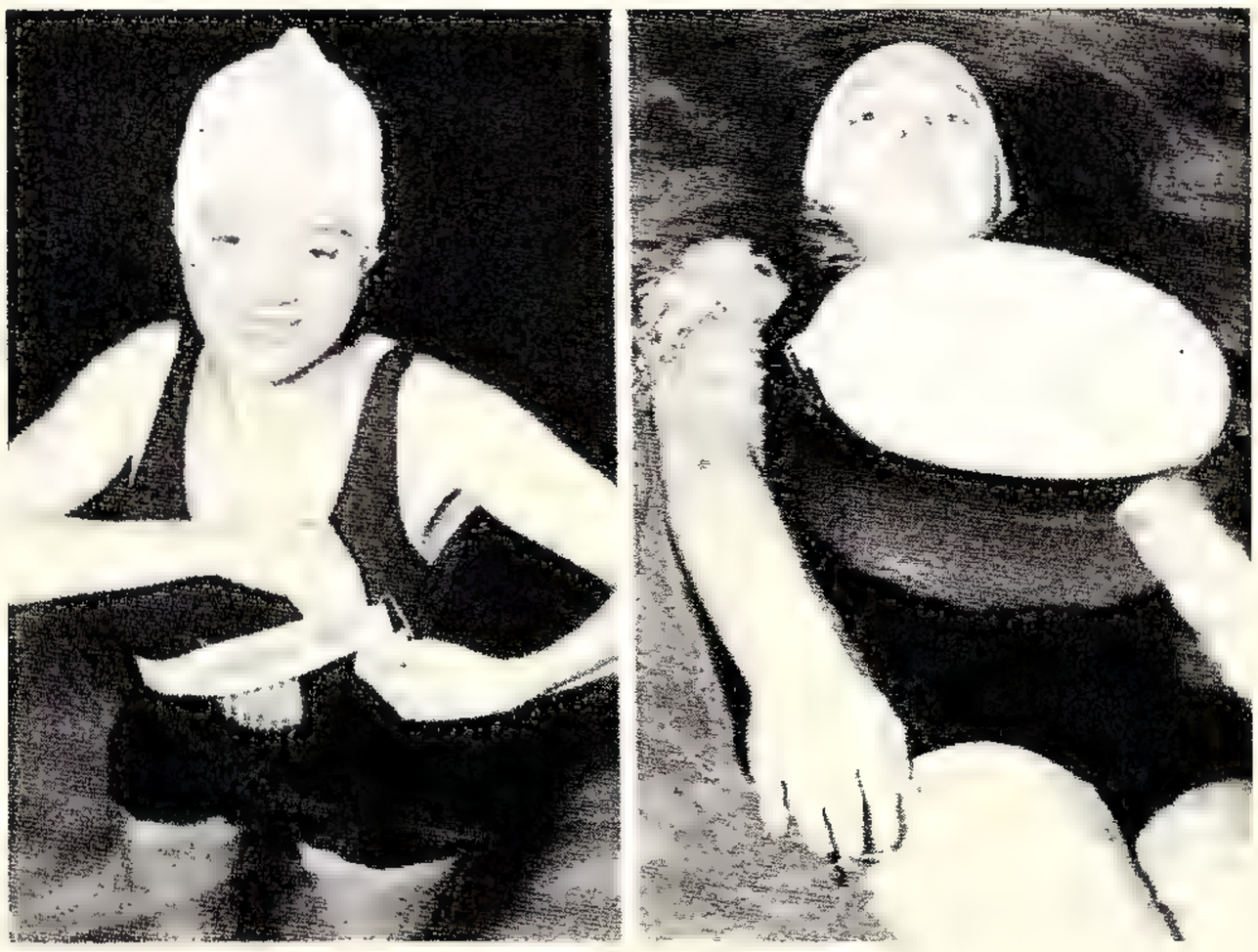


Device Tests Baseball For Liveliness

THE National Bureau of Standards in Washington, D. C., is conducting tests to determine whether or not the baseballs used by the American League are livelier than the balls used by the National League. The test device is an air gun that shoots a one-pound hard-wood projectile, representing a bat, against the balls. After the impact the balls are caught in a ballistic pendulum, by means of which their speeds can be accurately determined.

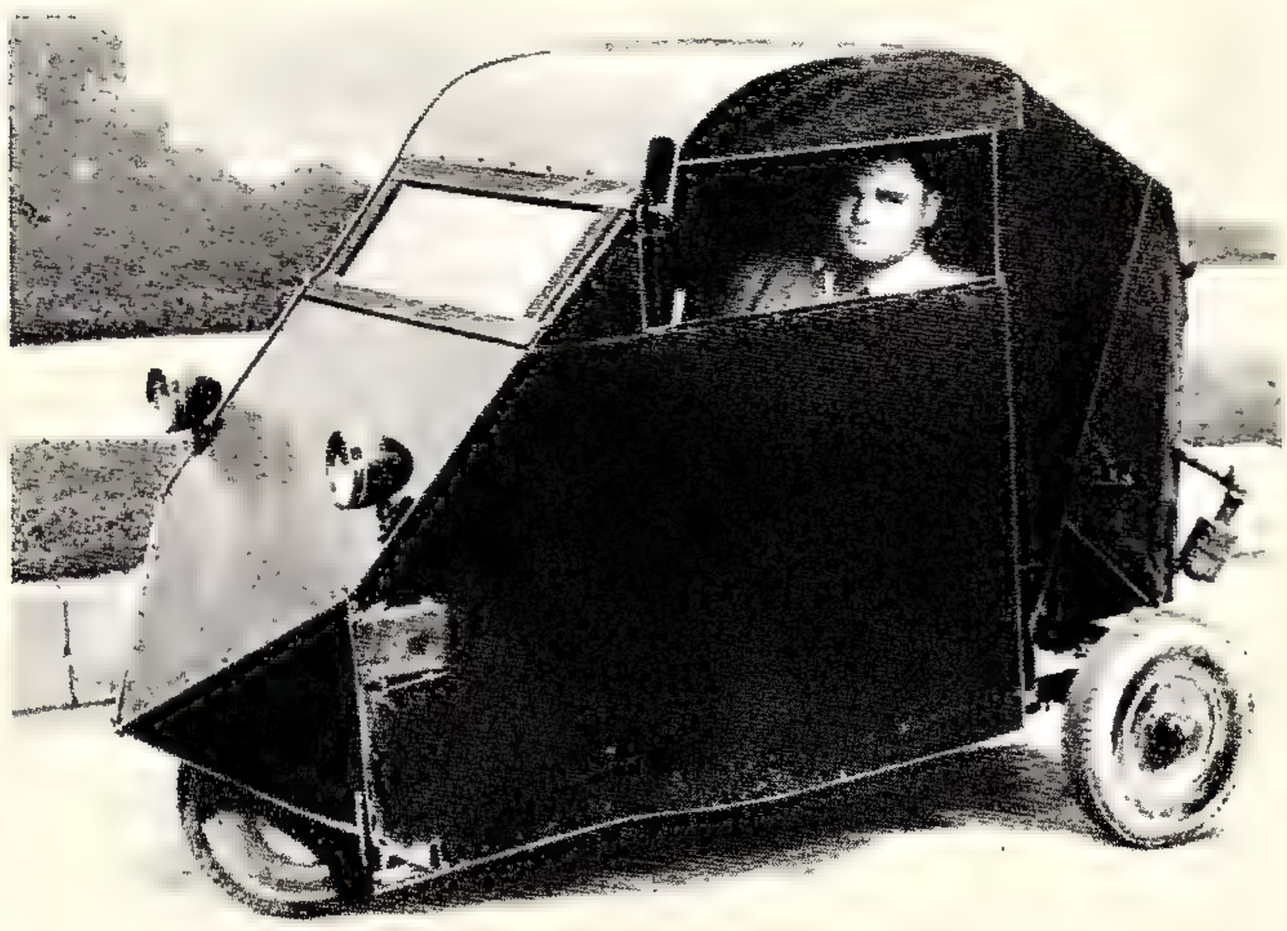
Life Preserver Blows Itself Up

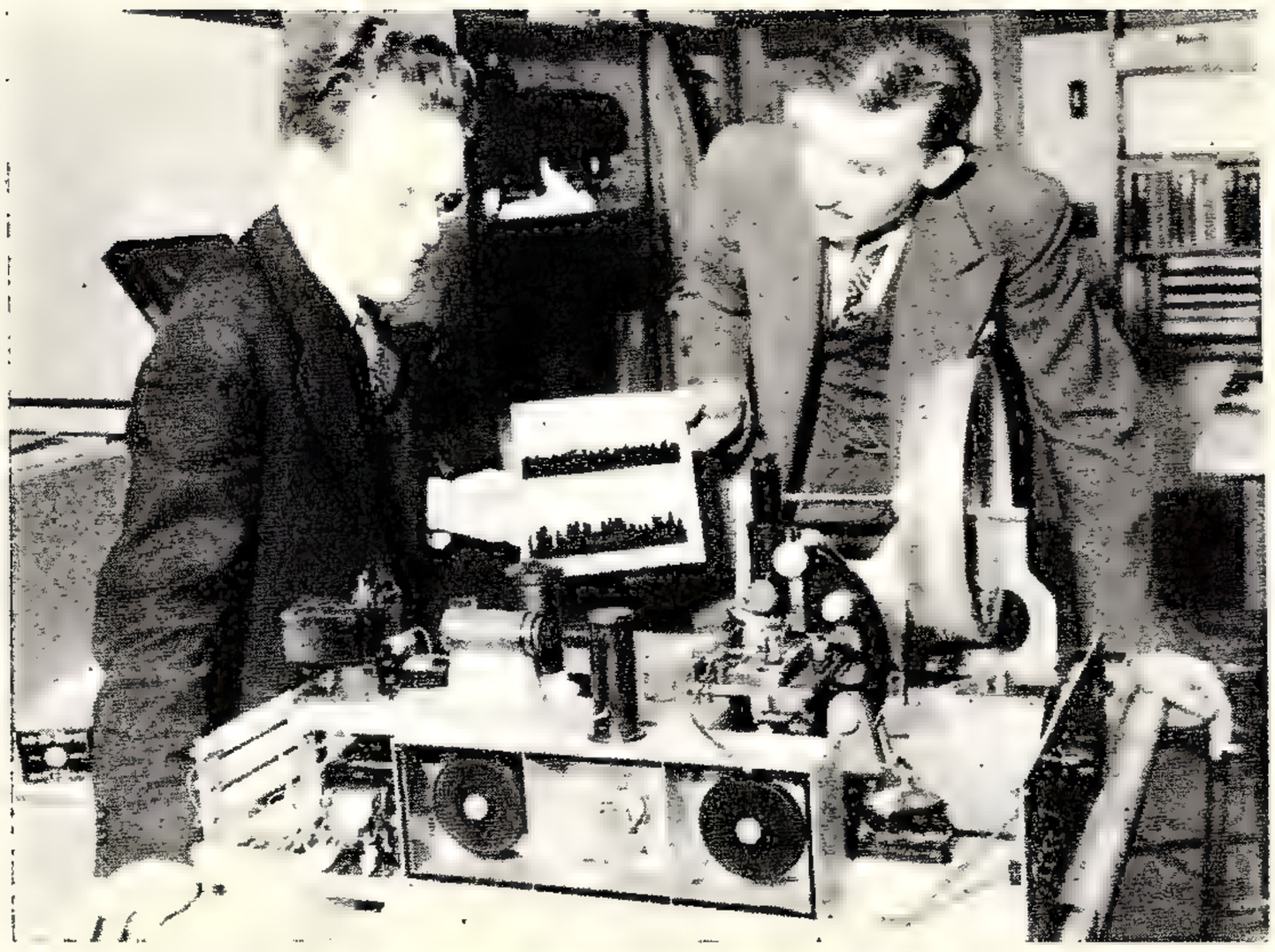
A NEWLY developed life preserver, which is easily fastened to clothes or a bathing suit, features a rubber envelope with a built-in compressed air container. By simply squeezing a small valve, the compressed air is released from the metal container and inflates the envelope. When fully inflated, the life preserver is said to support a heavy person for hours. Photos show the preserver deflated and inflated, as demonstrated by Georgia Coleman, famous swimmer.



Powered Wheel Chair Goes 25 M.P.H.

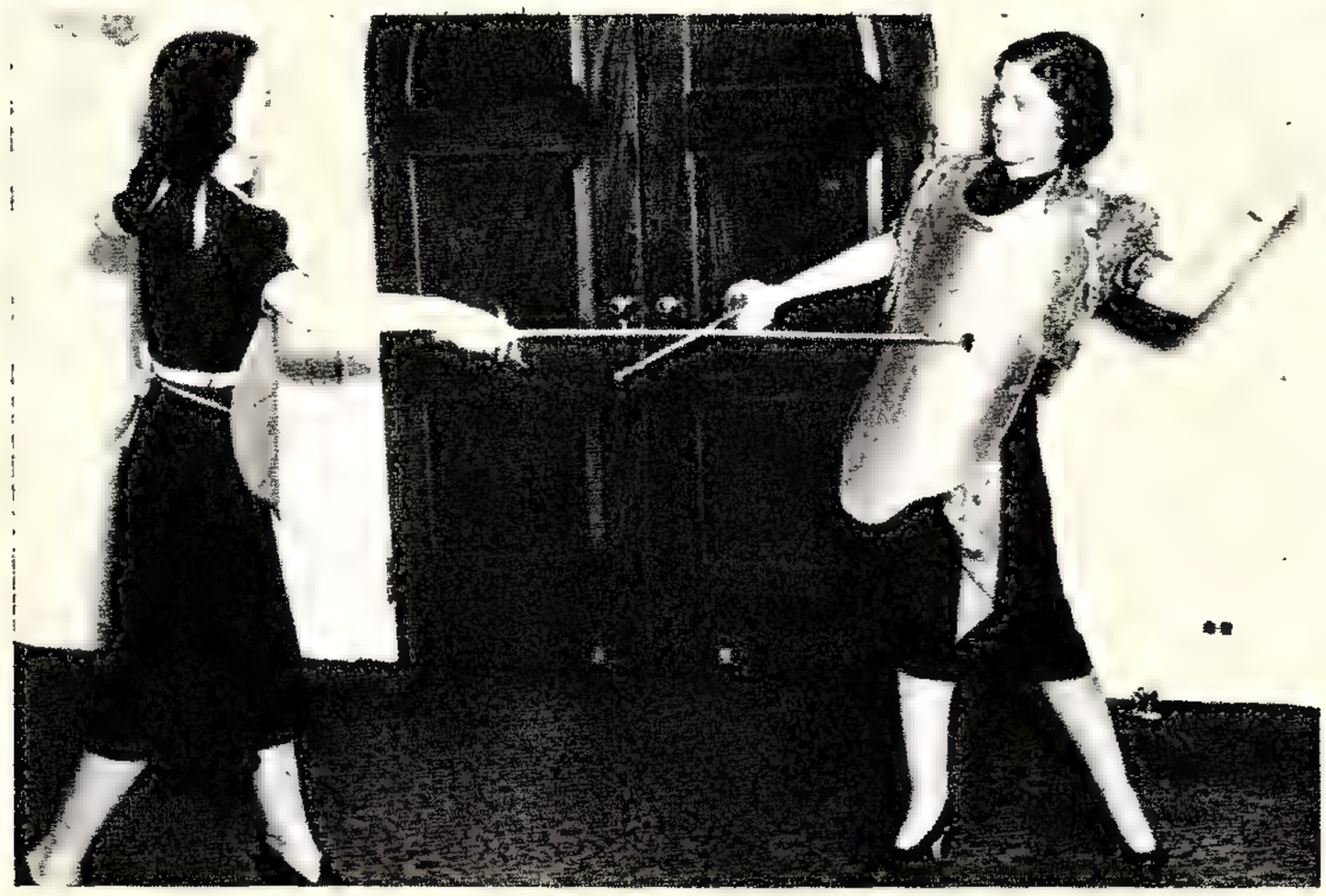
TIRED of pushing himself around in an ordinary wheel chair, Charles Bancroft, of Port Arthur, Texas, constructed a three-wheeled vehicle which resembles an armored car in its general appearance. The home-built car is powered by a two-horsepower motor salvaged from a lawn mower and features a motorcycle transmission, the combination enabling the vehicle to travel about 60 miles on a gallon of gasoline.





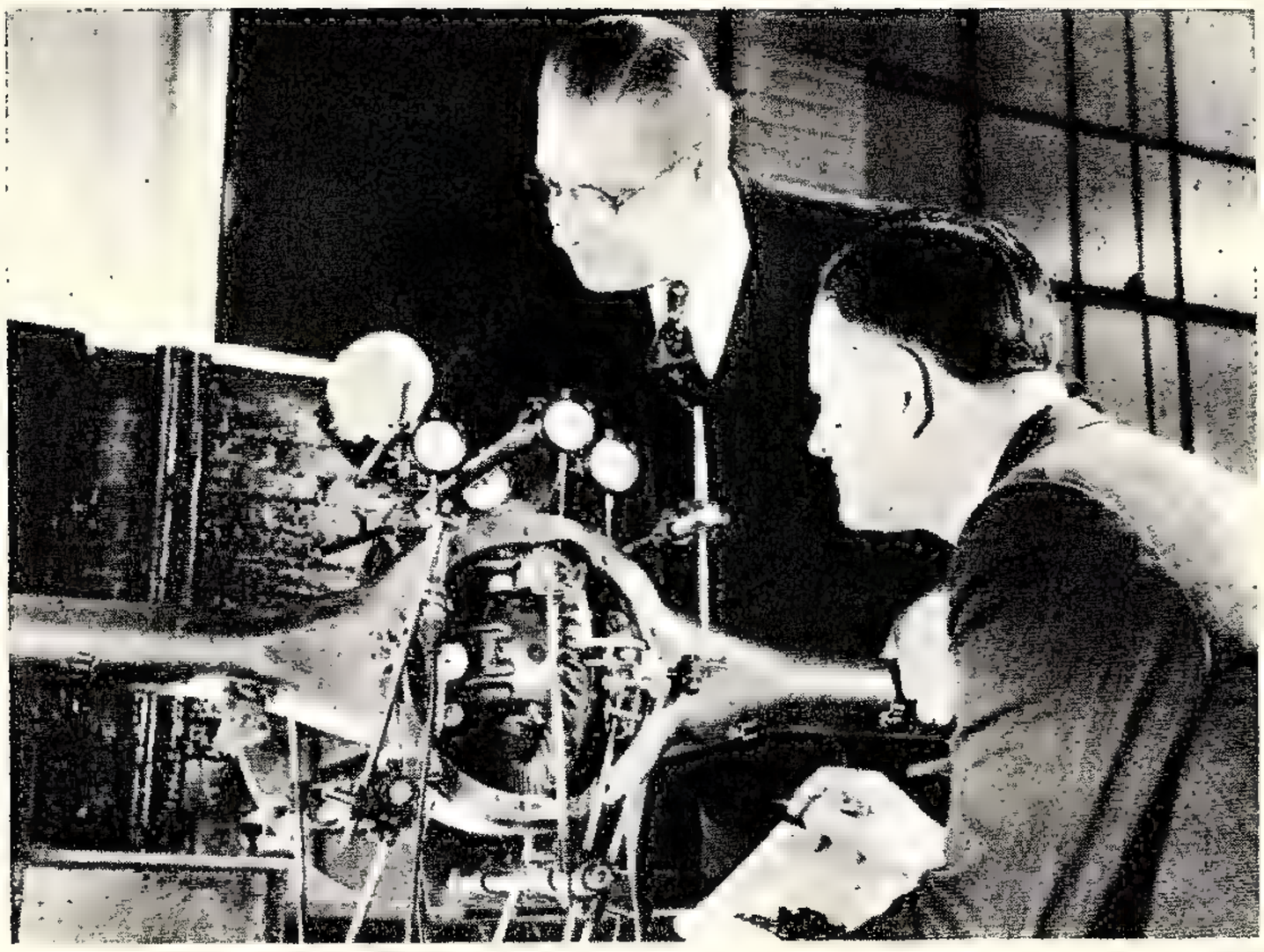
Probability Device Gives Exact Odds

A PROBABILITY machine capable of telling the average man's chance of being killed in an automobile accident, or even throwing a seven with a pair of dice, is now being constructed by Drs. Alexander Goetz and W. O. Gould, California Institute of Technology physicists. This machine also could be used in bacteria tests, to determine whether the death of one person would bring the death of others in the same neighborhood.



New Game Uses Wooden Foils

A NEW fencing game uses foils made of wood with suction cups on the ends. Shields made of cardboard are worn with various sections of the body marked off. Face protecting masks made of cardboard and wire mesh also are included. Shown demonstrating the outfit are Rita Hart (left) of Brooklyn, N. Y., and Ethel E. Battner, of Jamaica, L. I., N. Y.



Gauges Check Load On Axle

A UNIQUE test on a passenger car rear axle uses twelve gauges to measure every possible deflection assumed by the parts in the axle under given load conditions. A weight is hung on the drive shaft that corresponds to a maximum load on the axle during actual driving conditions. All movements or deflections of the drive shaft, pinion and ring gears and axle shafts are read simultaneously.

At the right a technician is attaching a skull to the spine of a skeleton. Special drills are used to make holes in the bones. Note skull being sawed in half.

A skeleton in need of reconditioning is unpacked and examined preparatory to having necessary repairs made. It is one of many sent in regularly by medical schools, nurses training schools and biological departments of colleges in this country.

AMONG this country's most unusual industries is that of repairing human skeletons; done by the Clay Adams Co., in New York City.

Practically every medical school, nurses training school and college biological department in the country keeps a skeleton on hand for instruction purposes. Often these skeletons must be repaired and cleaned, missing bones replaced, damaged or chipped bones repaired, and so on.

Extremely careful and painstaking is this procedure in order that a good reconditioning job can be turned out. Technicians with many years of experience in this field work patiently and skillfully in clean, well-lighted laboratories, taking plenty of time for this precision work.

A technician dismantles the skeleton by removing the wires and other materials holding the bones together. Extreme care is employed in this procedure so that the parts are not damaged.

New Life for Old Bones

MI Readers' Service Bureau

THIS new department, Readers' Service Bureau, is being introduced to make MECHANIX ILLUSTRATED an even more valuable magazine for you.

It is the opinion of the editors of MECHANIX ILLUSTRATED that too many readers of all magazines fail to realize the value of the advertising columns, and hence miss many instructive messages and opportunities to benefit themselves. The advertising section of any magazine is as much a part of the publication, and as important to the readers, as are the editorial articles and pictures. MECHANIX ILLUSTRATED censors its advertising stringently for your protection and therefore urges you with full confidence to take advantage of its advertising columns and the attractive offers made in them.

To bring them to your attention, we are listing in this department all advertisers' offers, with the exception of those made in the classified section. However, we strongly recommend that you study this section also for opportunities.

It will be the function of the Readers' Service Bureau to act as a clearing house for both readers and advertisers. On the opposite page you will find a complete listing of all offers made by advertisers in this issue, with the advertisers' names arranged in alphabetical order and with a convenient identifying number for each. To simplify the ordering of booklets, catalogs, samples, etc., the bureau will forward your requests promptly to *three or less* of the firms listed. Merely write your name and address clearly on the coupon on this page, mark the numbers of the offers you want, and mail the coupon, either in an envelope or on a post card, to the address on the coupon. We will do the rest.

It is important that you carefully study the offers themselves, so refer to the pages on which the advertisements appear before you order booklets or other materials. You may prefer to write directly to the advertisers, or you may wish to take advantage of more than three offers; in any event, be sure to mail your letters to the exact addresses given in the advertisements. The Readers' Service Bureau will have performed its service if it calls these offers to your attention.

If the booklets you select are listed as "free," the coupon is all you have to send. If there is a slight charge (usually only 3 cents and rarely more than 10 cents, to cover the cost of mailing bulky catalogs, booklets or samples), be sure to include the correct amount with the coupon. The most convenient way to make such small remittances is in the form of United States stamps or International Postal Coupons.

Remember, the Readers' Service Bureau is ready and willing to help you. Take full advantage of this unusual service!

Readers' Service Bureau,
MECHANIX ILLUSTRATED,
1501 Broadway,
New York, N. Y.

I am interested in the following offers:

☐ ☐ ☐
(Put numbers in squares)

I am enclosing ..... cents in stamps.
(Ignore this line if all offers are free.)

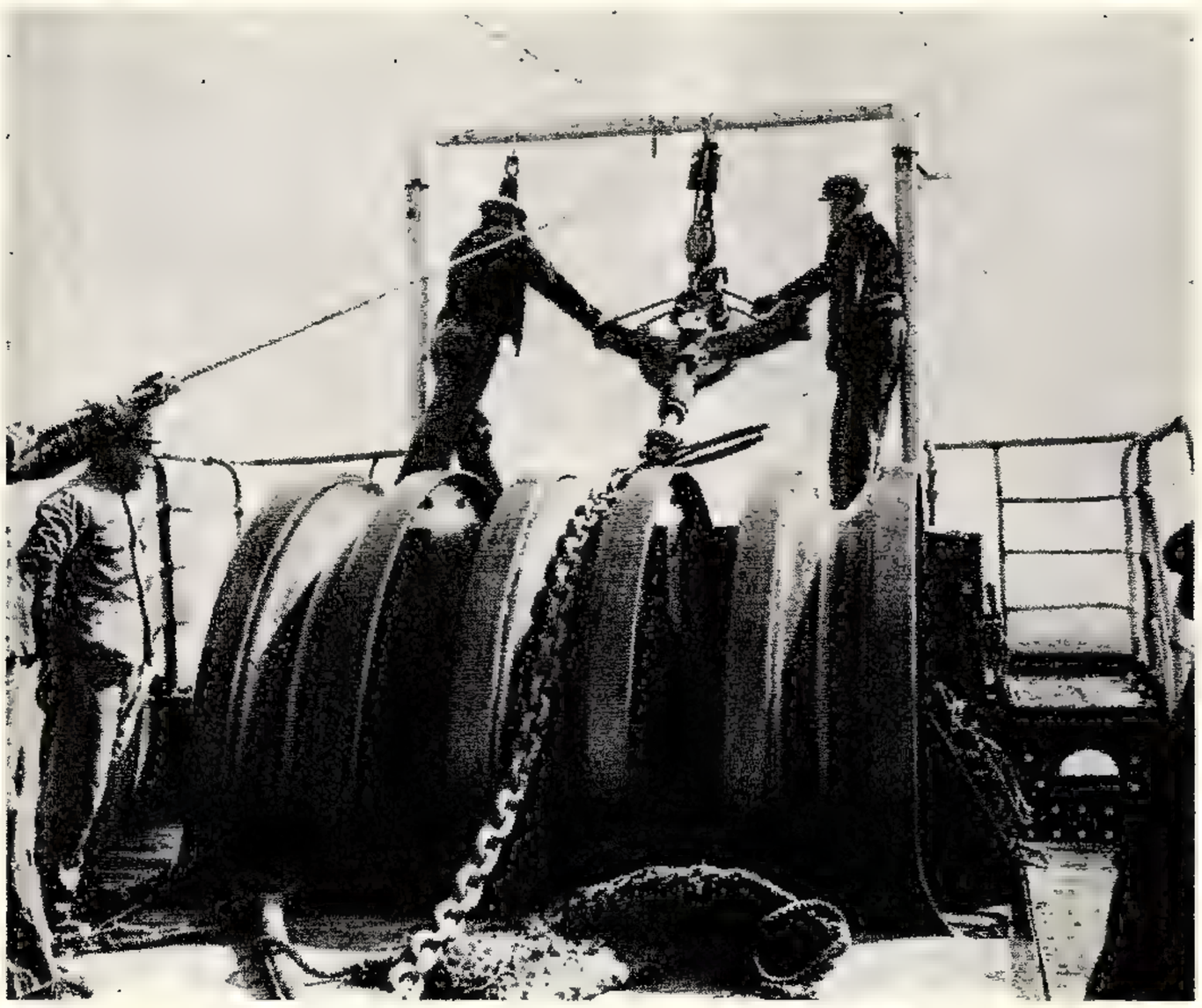
Name .....

Address .....

City and State .....

Note: This offer expires August 15, 1938. After this date, write directly to advertisers for offers.

Offer No.	Firm	Type of Business	Offer Made	Charge	Ad Appears on Page
1	L. L. Adcox Trade School	School	Catalog	Free	17
2	Allied Radio	Radio	Catalog	Free	21
3	American School	School	Information	Free	24-17-23
4	American School of Photography	School	Booklet	Free	142
5	Aurora School of Photo-Engraving	School	Booklet	Free	137
6	Benjamin Air Rifle	Air Guns	Details	Free	18
7	Bild-Ur-Own Devices	Kits	Information	Free	143
8	Bliss Electrical	School	Catalog	Free	8
9	Brownscope Co.	Telescopes	Catalog	Free	136
10	Central Camera Co.	Photographic Supplies	Almanac	Free	142
11	Chicago Technical College	School	Trial Lesson & Blue Book	Free	143
12	Chicago Wheel & Mfg. Co.	Tools	Catalog	Free	145
13	The College of Swedish Massage	School	Chart & Booklet	Free	144
14	Coyne Electrical School	School	Catalog & Book	Free	20-136
15	Craftsmen's Wood Service	Wood-Working Supplies	Catalog	10 Cents	138
16	The Cushman Motor Works	Power Scooters	Literature	Free	144
17	Delta Mfg. Co.	Tools	Book	10 Cents	18
18	Dremel Mfg. Co.	Tools	Booklet	Free	27
19	Electro-Torch Co.	Welding Equipment	Particulars	Free	Inside cover
20	Elite Publishing Co.	Business Opportunities	Book	Free	21
21	Engineer Dobe	School	Book	Free	24
22	Victor J. Evans	Patent Attorneys	Books	Free	11
23	Evinrude Motors	Outboard Motors	Catalog, Boat Directory, and Boat and Motor Selector	Free	26-143
24	Franklin Institute	School	Book	Free	25
25	GHQ Motors	Model Gas Engines, Kits	Catalog	3 Cents	136
26	Gunmetal Co.	Plating	Particulars	Free	26
27	Harley-Davidson Motor Co.	Motorcycles	Literature & Magazine	3 Cents	24
28	Hobart Bros.	Welding Equipment	Booklets	Free	19
29	Hull Mfg. Co.	Compass Equipment	Circular	Free	26
30	Institute of Applied Science	School	Report, Literature	Free	27
31	International Correspondence Schools	School	Booklet	Free	3-15
32	Kayak Boat Co.	Boats	Assembling Plan & Catalog	10 Cents	138
33	Kelsey Presses	Printing Presses	Catalog	Free	138
34	LaSalle Extension	School	Book	Free	9-26
35	LeJay Mfg. Co.	Electrical Equipment	Plans and Catalog	10 Cents	6-140
36	Lincoln Airplane & Flying School	School	Information	Free	142
37	Lincoln Engineering School	School	Catalogue, Student Magazines & Details	Free	140
38	Lockwood Compass Company	Compass Manufacturer	Folder	Free	18
39	Marvel Trailer Parts Co.	Trailer Parts	Catalog	10 Cents	142
40	Mead Cycle Co.	Power Scooters	Folder	Free	136
41	Mead Gliders	Portable Boats	Circulars	10 Cents	26
42	Mechanix Universal Aviation Service	School	Particulars	Free	26
43	Michigan Trade School	School	Circulars	Free	144
44	Carl Miller	Patent Attorney	Book	Free	8
45	Albert Mills	Business Opportunity	Facts	Free	144
46	National Potteries Co.	Pottery Equipment	Booklet, Colorplate	10 Cents	140
47	National Poultry Institute	Poultry	Book	Free	8
48	National Radio Institute	School	Book	Free	5
49	National Schools	School	Book	Free	13-18
50	New York Institute of Photography	School	Booklet	Free	142
51	Clarence A. O'Brien & Hyman Berman	Patent Attorneys	Book	Free	7
52	Page-Davis School of Advertising	School	Booklet	Free	21
53	Parks Air College	Aviation School	Catalog	Free	136
54	Plastex Industries	Plastex	Book	Free	21
55	Progress Tailoring Co.	Clothing	Details & Samples	Free	26
56	Prout Mfg.	Tools	Details	Free	26
57	L. F. Randolph	Patent Attorneys	Booklet	Free	6
58	Raye Burns School	School	Details	Free	144
59	The Rosicrucians	Philosophy	Book	Free	140
60	Sentinel	Electric Fence	Details	Free	21
61	Shamrock Trailer Parts	Trailer Parts	Catalog	Free	140
62	C. A. Snow & Co.	Patent Attorneys	Books	Free	6
63	South Bend Lathe Works	Tools	Catalog	Free	8
64	Standard Business Training Institute	Home Study Course	Booklet	Free	141
65	J. A. Stransky	Gas Economizer	Sample	Free	19
66	United Mushroom Co.	Mushrooms	Book	Free	26
67	Universal Photographers	Home Study Course	Catalog	Free	143
68	U. S. School of Music	School	Book & Demonstration Lesson	Free	16
69	The Way Co.	Hearing Aids	Booklet	Free	26
70	Wholesale Radio Service	Radio & Camera Supplies	Catalog	Free	137
71	Wisconsin School of Watch Repairing	School	Particulars	Free	141
72	World's Products	Business Opportunity	Book	Free	24

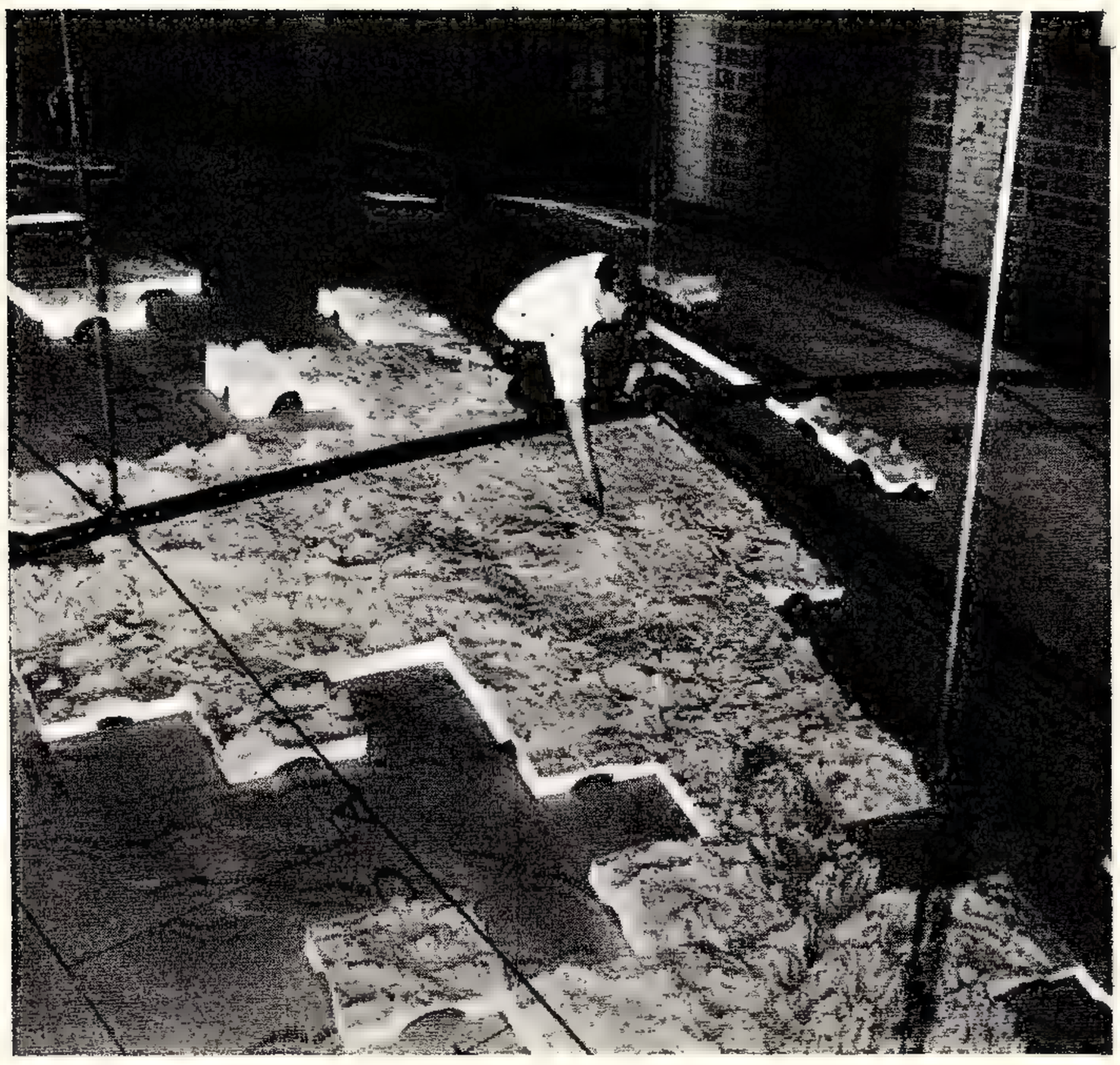


Biggest Chain Built For Cable Ship

CLAIMED to be the world's largest, a 4,200-foot nickel steel chain has been specially constructed for use aboard the cable ship *Lord Kelvin.* It will be used to drag a blade that will plow the cables into the ocean bottom in an effort to protect them from heavy drags used by fishing vessels. The huge chain has 12,500 links, each weighing three and one-half pounds, and is capable of withstanding a stress of 65,000 pounds. The photo shows the chain being lowered overboard.

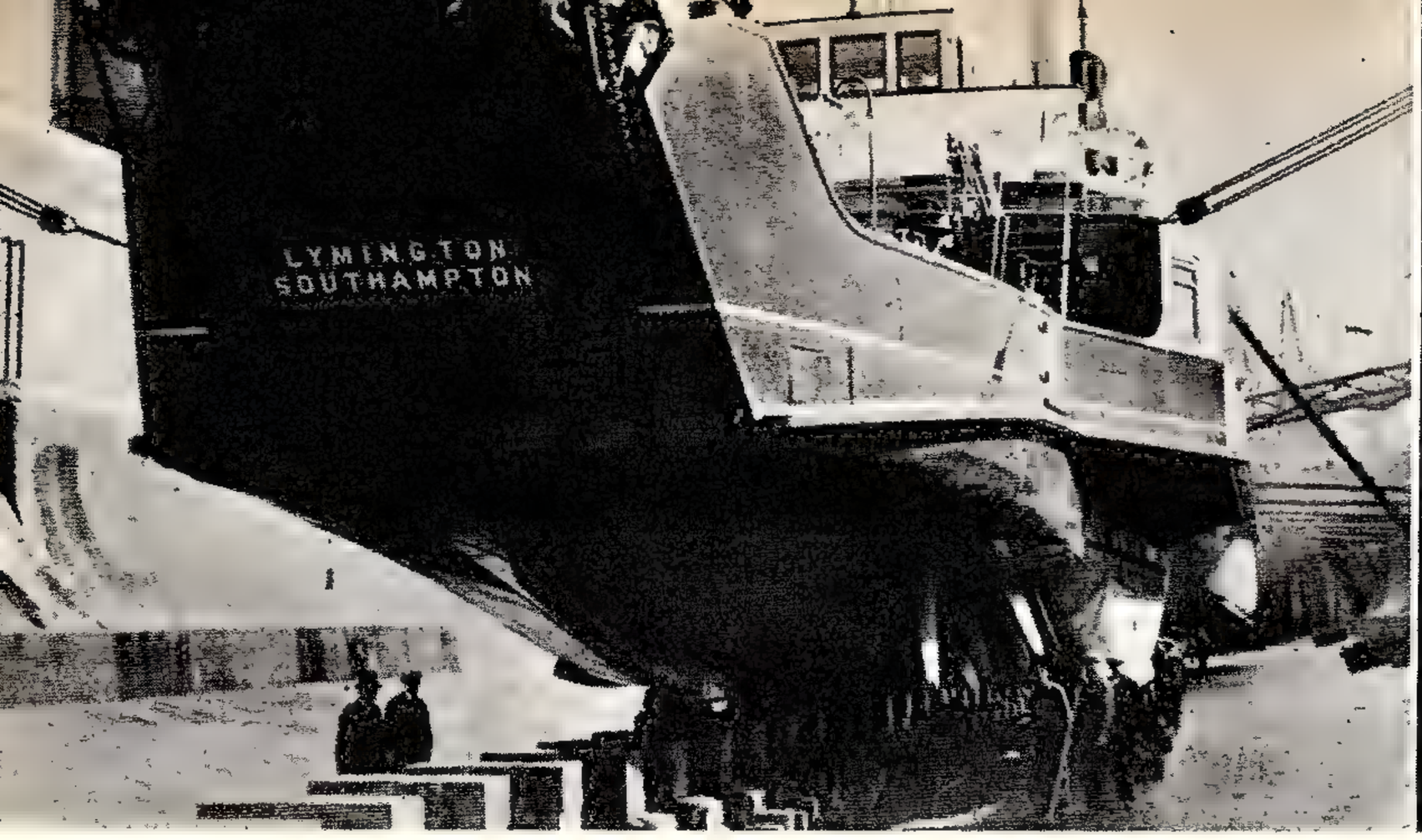
Dog Fitted With False Teeth

"MACKENZIE BOY," an aged Boston terrier pet owned by an Aberdeen, Wash., resident, is believed to be the first dog ever fitted with a complete set of false teeth. Dr. D. Fosland, of Aberdeen, constructed the artificial molars for the dog and it is claimed they enable the canine to masticate properly.



Relief Map Shows Earth's Curve

BUILT on a spherical surface in exact proportion to the earth's curvature, a huge relief map of the United States is being constructed at the Clark University Graduate School of Geography in Worcester, Mass., under the direction of Dr. Wallace W. Atwood, Jr. The map, the scale of which is four miles to the inch, will show all the topographical features of the country and when completed it will be housed in a special building on the campus of Babson Institute in Boston. The photo at left shows the map as it appears at present.



Novel Propellers Eliminate Rudder On Ferry Boat

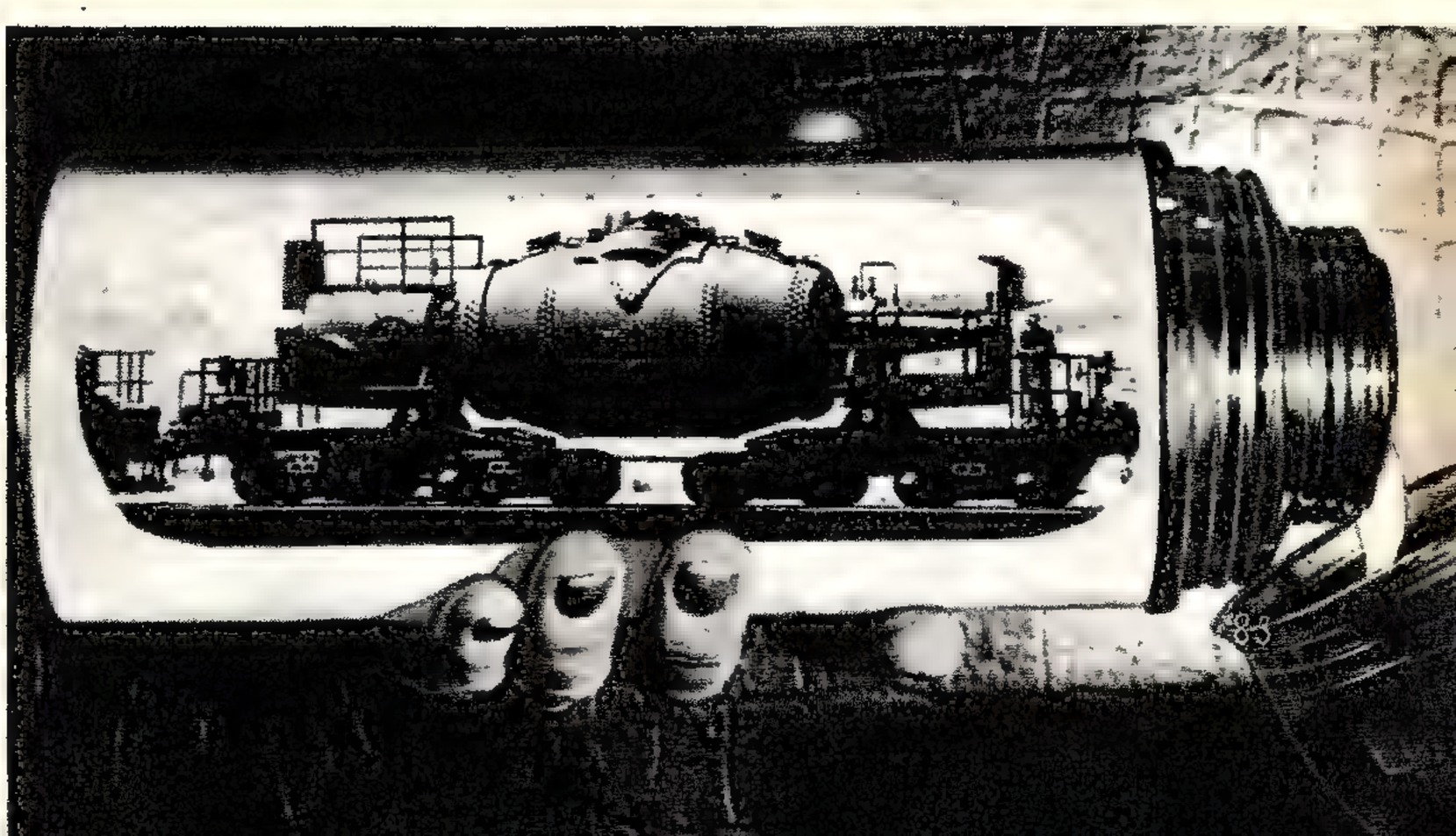
ELIMINATING the need for rudders, a newly constructed double-ended ferry boat in London, England, is equipped with two special propellers which enable the craft to move crab-fashion in any direction. The propellers resemble a series of vertical spikes, as shown above, and one is located at each end of the boat on opposite sides of the center line. The angle of the spike-type blades can be adjusted so that they will propel the boat forward, backward or sideways. The ferry boat can carry 400 passengers and 20 autos.

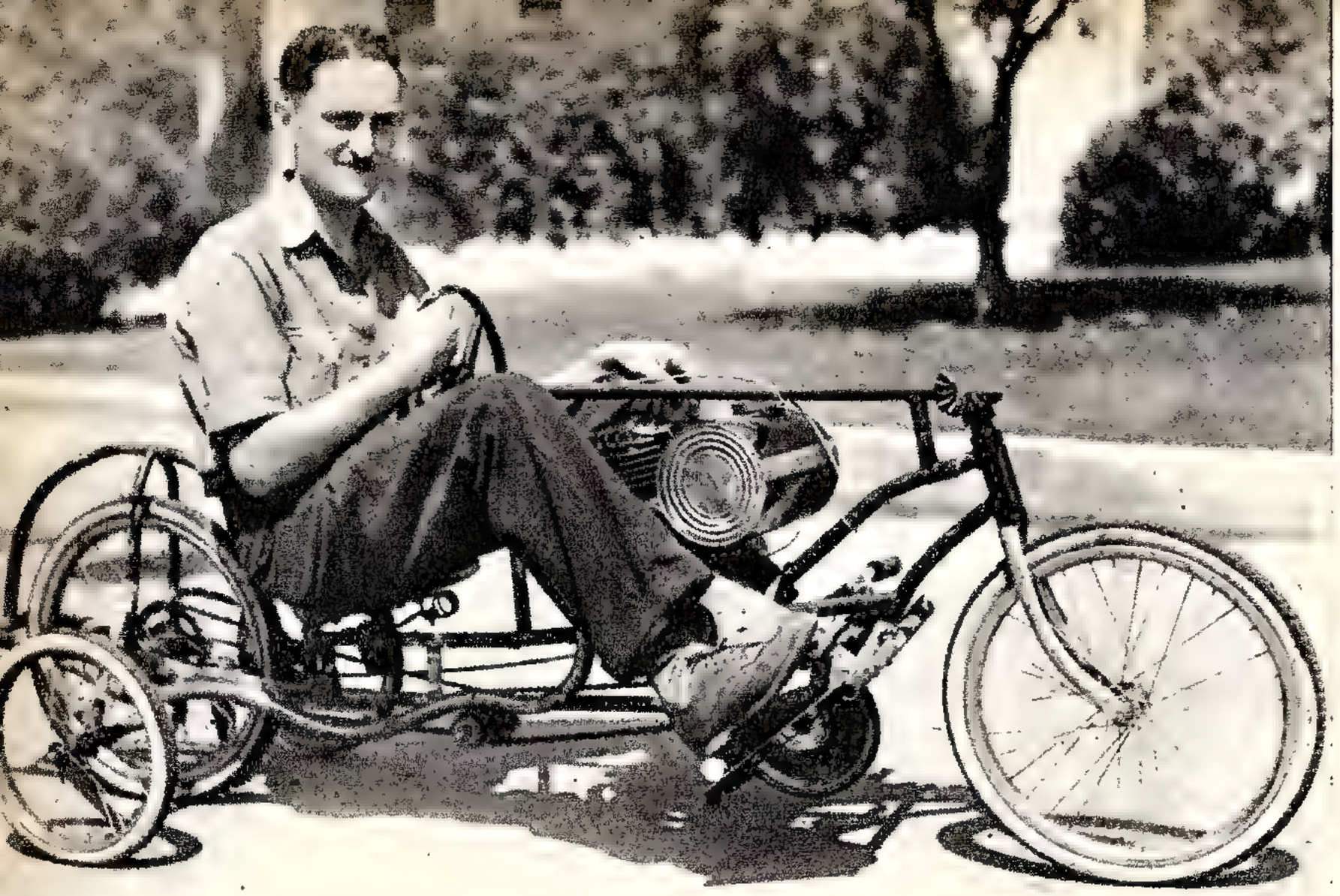
Device Tests Tone Of Musical Instruments

DEVELOPED by a well known musical instruments manufacturer, a new chromatic stroboscope device provides a precise, visual method of checking the intonation of pianos, wind instruments and a singer's voice. When a note is sounded on the musical instrument being tested, a microphone picks up the sound and carries it to the stroboscope where it is automatically compared with an electric tuning fork, the degree of sharpness or flatness being indicated on a dial.

Car Hauls Hot Copper

LINED with 18-inch-thick magnesite, a new type freight car is actually a huge vacuum bottle in effect, enabling molten copper to be transferred conveniently from widely separated smelting and refining plants.





Builds Novel "Automobile"

POWERED by a half-horsepower gasoline engine taken from an old lawn mower, a novel vehicle constructed by R. L. Shepard, of Los Angeles, Calif., has four wheels, but actually runs on two, one pair being used only as balancers when making turns, driving at slow speeds and stopping.

English Plane Has Largest Retractable Wheel Gear

DESIGNED for use on a giant English air liner and believed to be the largest yet built, a new hydraulic retractable landing gear mechanism features two jacks with an extended length of seven feet and which exert a maximum thrust of six tons. When in a complete down position, the landing gear is held rigidly in place by internal locks, each of which can withstand a load of ten tons.

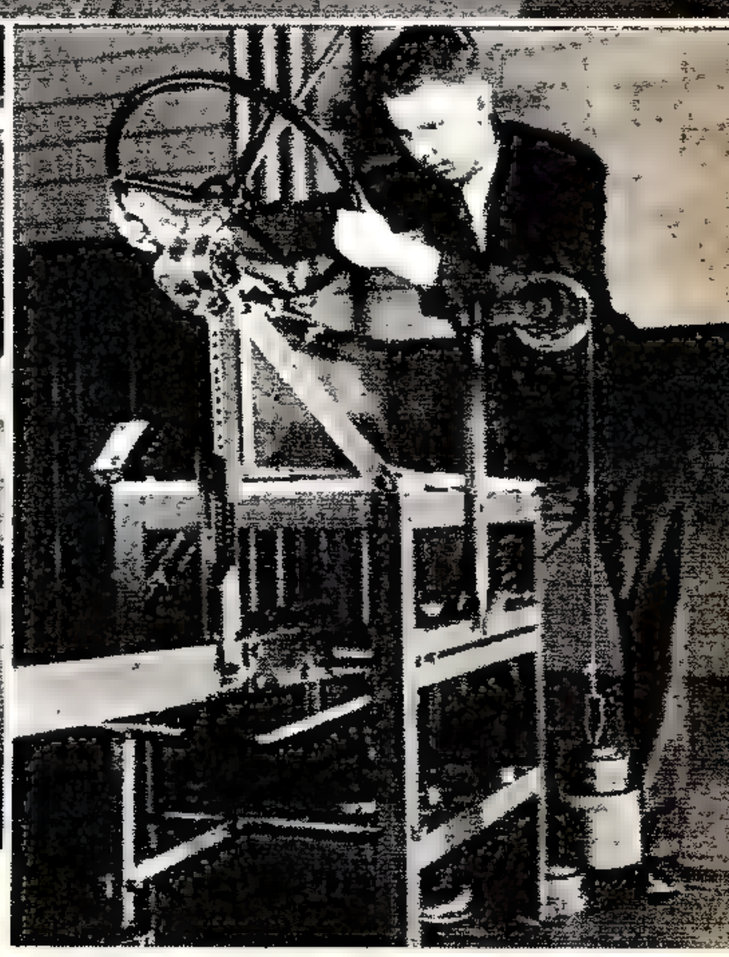
The entire landing gear mechanism is interlocked with a wing door, which cannot be shut until the wheel is fully retracted, nor can the wheel begin to fall until the door is fully opened. The complete system is operated by three pumps connected to the air liner's engines and controlled by two levers located in the pilot's compartment.

Wading Outfit Lets Fisherman Float

A NEWLY developed wading suit enables a fisherman not only to wade into a stream, but to float from spot to spot as well. The suit consists of a circular air-filled chamber, rubber wading boots and a water-proof body coverall comprising an integral, leak-proof unit, as shown in the photograph at left.

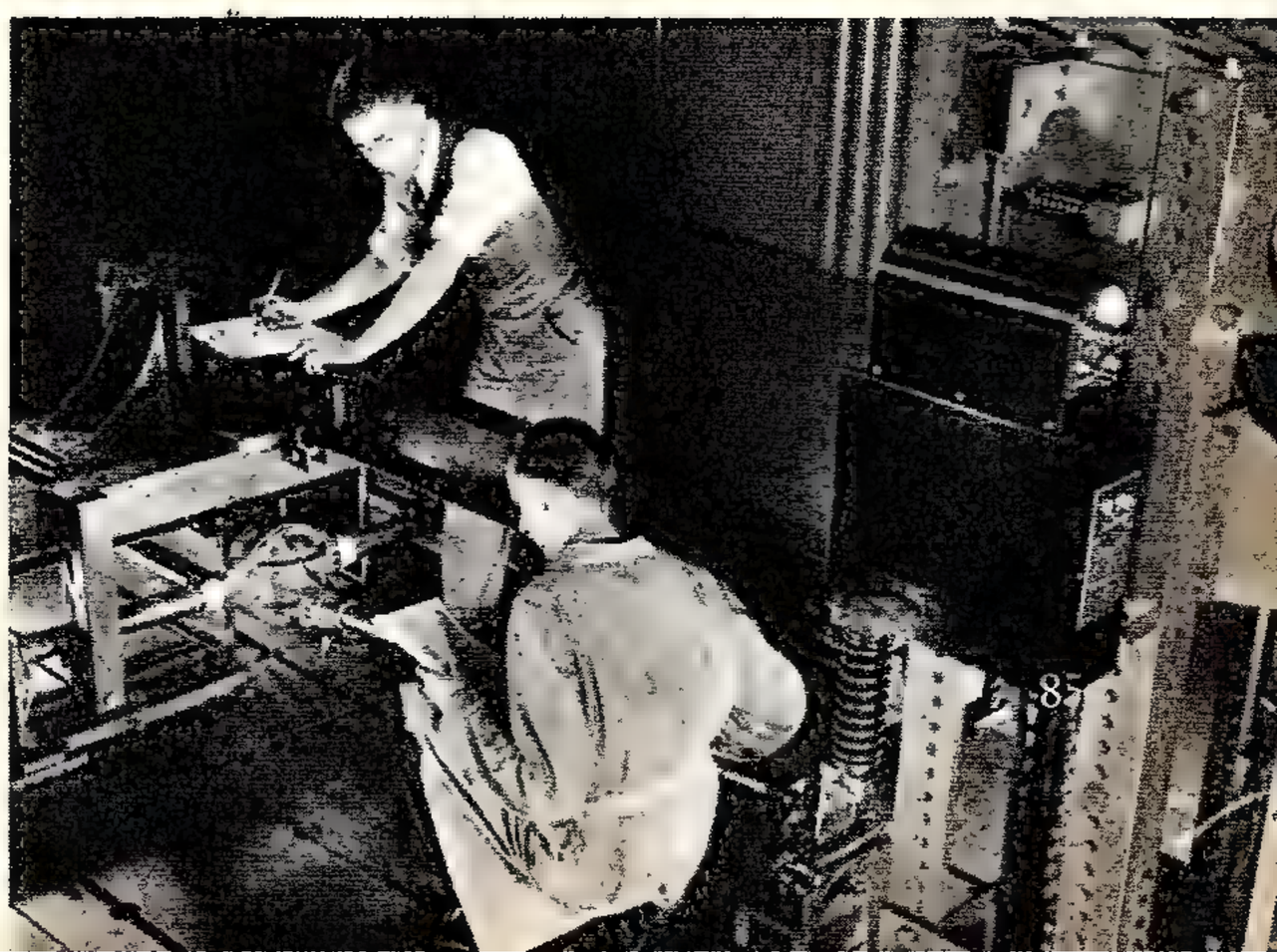
Laboratory "TORTURES" CARS

The photo above shows an electric dynamometer room in the new automobile experimental testing laboratory recently erected in Detroit, Mich. To test the power of a gasoline engine by means of the dynamometer, the engine is coupled directly to a dynamo machine. Connected to the dynamo are two accurate electrical measuring instruments, one a voltmeter and the other an ammeter. Since amperes multiplied by volts equals watts and there are 746 watts to one horsepower, the power output of the gasoline engine can thus be computed by taking the meter readings. Right—An auto being tested on a "bump rig". Metal cleats, attached to a rotating wheel, contact the wheels of the test car, simulating the bumps encountered while driving over rough roads.



HOUSING 17 rooms filled with equipment which is used to "torture" cars almost to the breaking point in order to solve engineering problems that arise with the design and production of new autos, a new experimental testing laboratory has recently been opened in Detroit, Mich., by a well known automobile manufacturing company. The major test equipment includes 11 dynamometers, ranging in capacity from five to 300 horsepower, a chassis rolling machine, four stroking machines, a clutch testing device and a universal tension-compression machine. The laboratory tests do not replace the usual road tests, but correlate them, enabling the engineers to draw conclusions in a few days instead of months. Some of the most important tests are shown in the photos.

Connected to weights by a wire cable (above, right), a steering gear is tested to check its ability to function properly under stress such as occurs when motoring over rough, bumpy roads or when a front-wheel blowout takes place. Below—One of the "tortures" to which cars are submitted in the new test laboratory is the stroking machine shown here. A load of 10,000 pounds is alternately applied and released at a rate of 120 times per minute for several hours, sometimes days.



The American Flag ON STAMPS

by Montgomery Mulford

THE flag of the United States has not appeared upon very many postage stamps. The first time that Old Glory was seen on a stamp was with the thirty-cent value issued in 1869. It is in natural colors, draped about a shield.

The second appearance of our flag on a stamp occurred in 1898 with the five-cent Trans-Mississippi issue of postage. We see Fremont planting the flag, in 1842, on the Rocky Mountains.

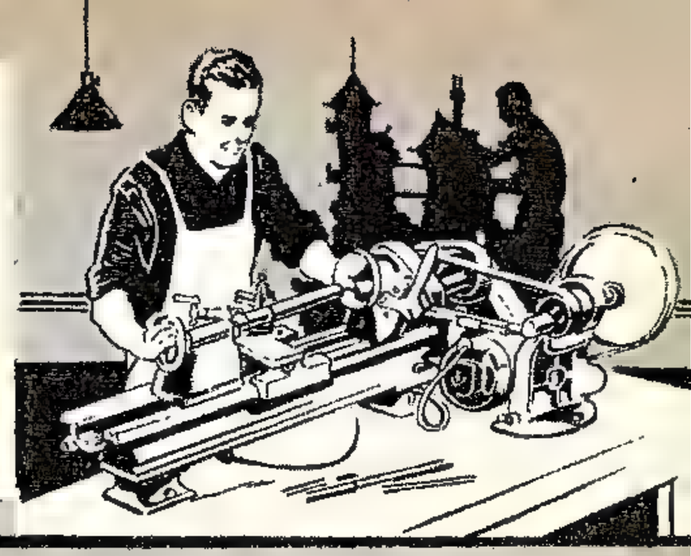
The third time that the U. S. flag is shown by on stamp is by the Hudson-Fulton two-cent carmine adhesive of 1909; and the fourth time with the 1919 Victory issue.

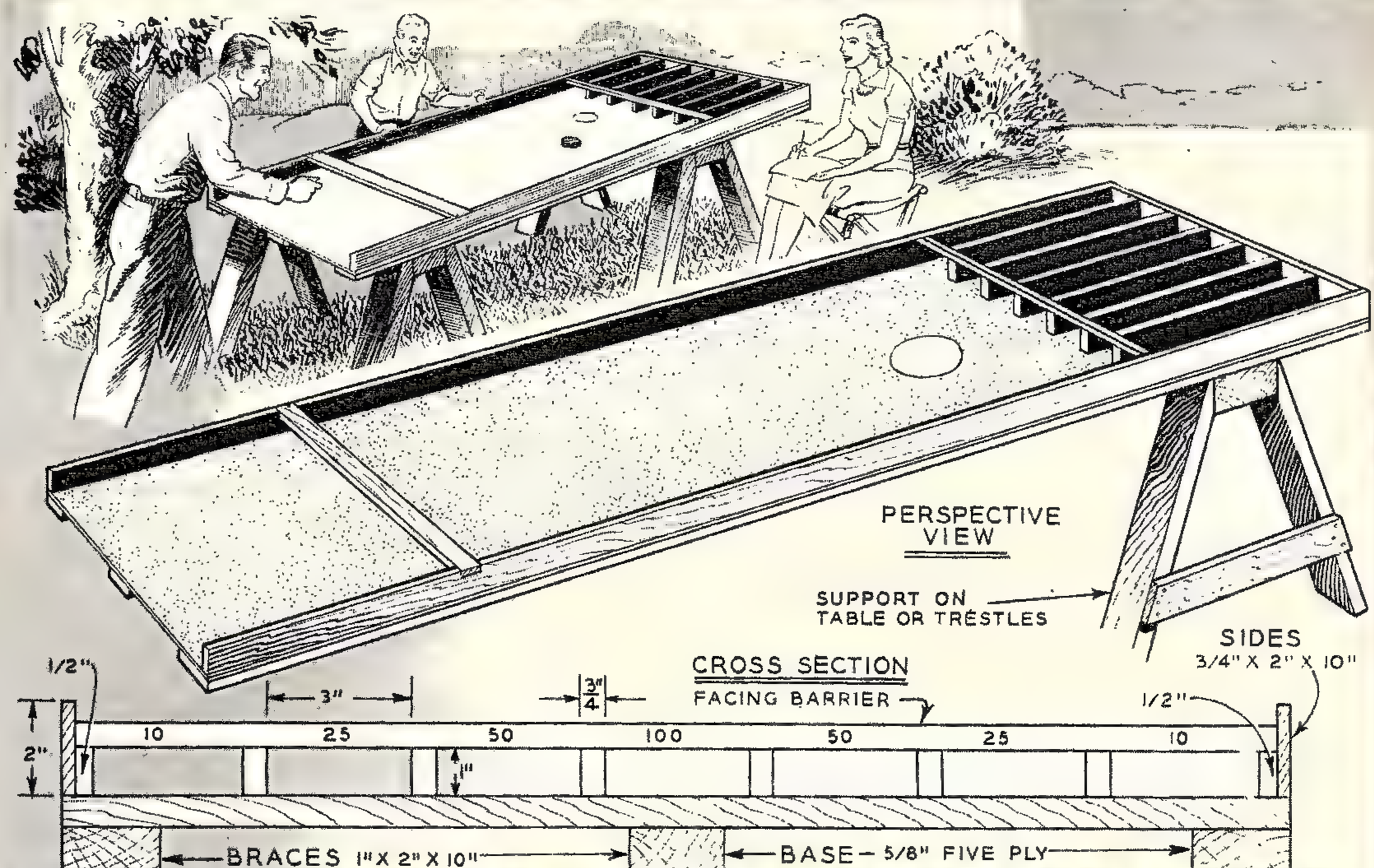
The Norse-American issue of 1925, a five-cent value, again pictures our attractive national ensign. The year following, we find the White Plains stamp (two cents), showing one of the colonial flags. A few other stamps show flags earlier than the "Stars and Stripes." The Michigan centennial three-cent stamp of 1935 shows this flag, with its forty-eight stars — most of the previous examples of our flag showing less than that number, because the last two states were not admitted until 1912!

A few foreign countries have issued stamps showing our flag. Honduras, Ecuador, Salvador, and Brazil each have shown the United States "Stars and Stripes" upon a stamp. Brazil's stamp shows thirty-two flags in all — the greatest number on any stamp, issued in 1936, a 300 reis value, commemorative of an Esperanto congress.

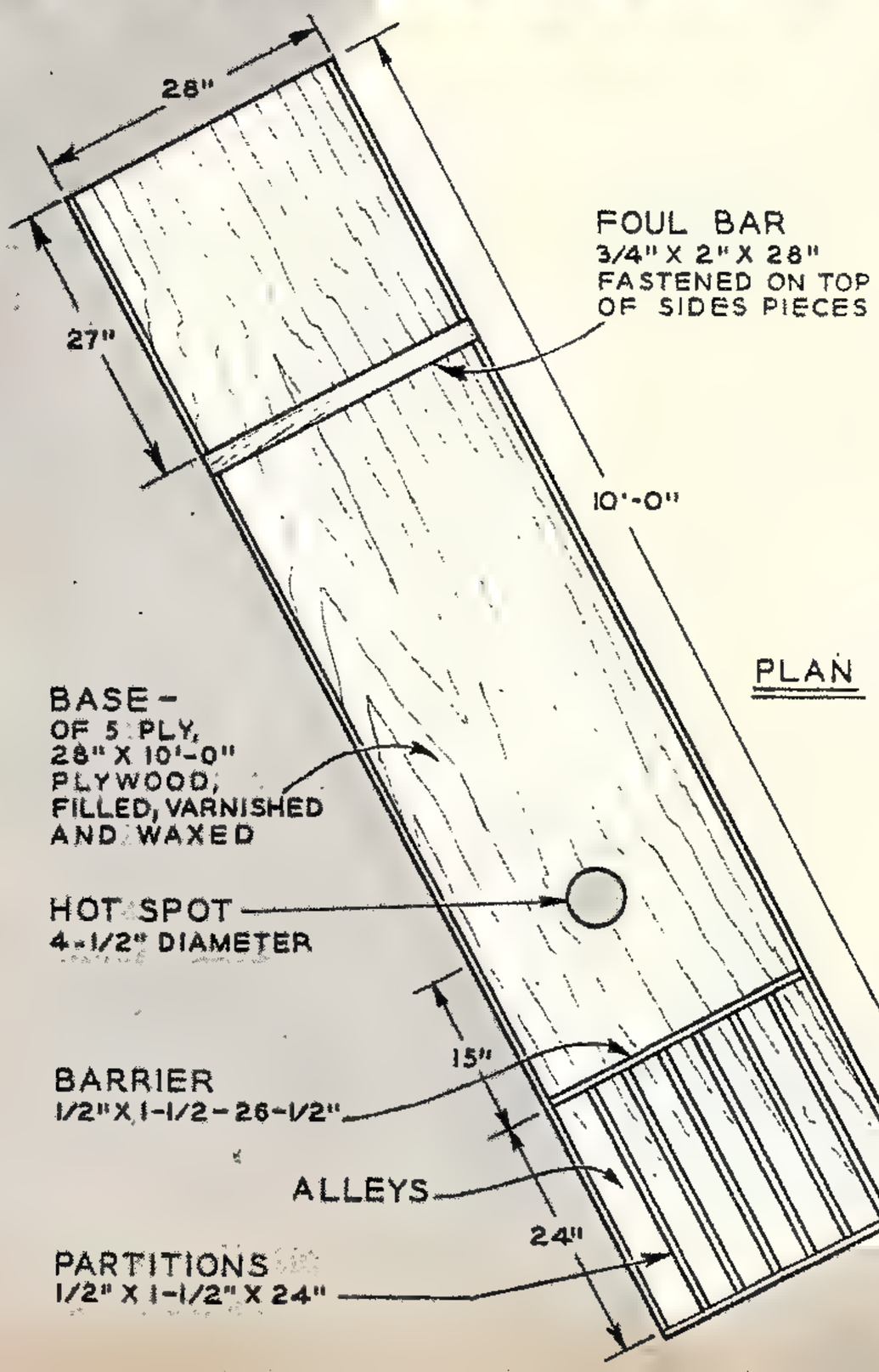
Many stamps bear flags, but the U. S. flag is not shown as many times as we might suspect. A flag collection, of the national ensigns on postage stamps, is very interesting to make.

CRAFTS AND HOBBIES





LANDLUBBER'S SHUFFLEBOARD



ALL boys and girls up to the age of 95 will enjoy showing their skill at this game. It is also an excellent way to develop steady and accurate wrist action. Two, three or four persons can play in competition. The board can be set up on the dining-room table, or on trestles in the basement or backyard.

The construction is straightforward and if the diagrams are followed carefully the board will stand hard use for years, but if portability is important the braces and base can be lightened somewhat. To make the playing disks, turn out on the lathe a cylinder of hard wood, exactly 2¾ inches in diameter and about 16 inches long. Saw into ½-inch slices. Twenty-eight disks should be made. The disks and the floor of the board should be well sanded, given three coats of good quality varnish, and polished with floor wax. There are four sets of disks, red, green, blue and yellow, with

[*Continued on page* 142]

HOW PLAIN IS YOUR HOUSE NUMBER

THE boys who drive the delivery trucks for any large department store will tell you that one of their pet peeves is illegible or entirely missing house numbers. Of course bill collectors seem to have no trouble finding the right place, but that is another story.

Nine out of ten house numbers are of the conventional metal type obtainable at any hardware or variety store. These are all right so long as they are in plain sight and properly placed on the house or porch with the necessary contrast between number and background so that a stranger in the neighborhood can read them easily. By contrast is meant black on yellow, gray on red, green on white, or any of the numerous combinations which are possible and at the same time maintain color harmony.

Good looking, appropriate house numbers can be provided in such a vast variety of styles and combinations that this often can be the first practical project for the man who newly acquires a home basement shop. In fact, more than one enterprising chap with a good eye for design, some spare time on his hands and a few tools in his shop, has made a good profit by selling house numbers in his neighborhood. Both metal and wood are ideal materials to work. Especially is it true that hand wrought numbers, designed and executed for a particular home, can bring fancy prices.

Perhaps the simplest number of all is made with a stencil. Oiled cardboard or special stencil paper, is used. The number is laid out in pencil then cut through with a razor blade or jig saw, this held over the surface

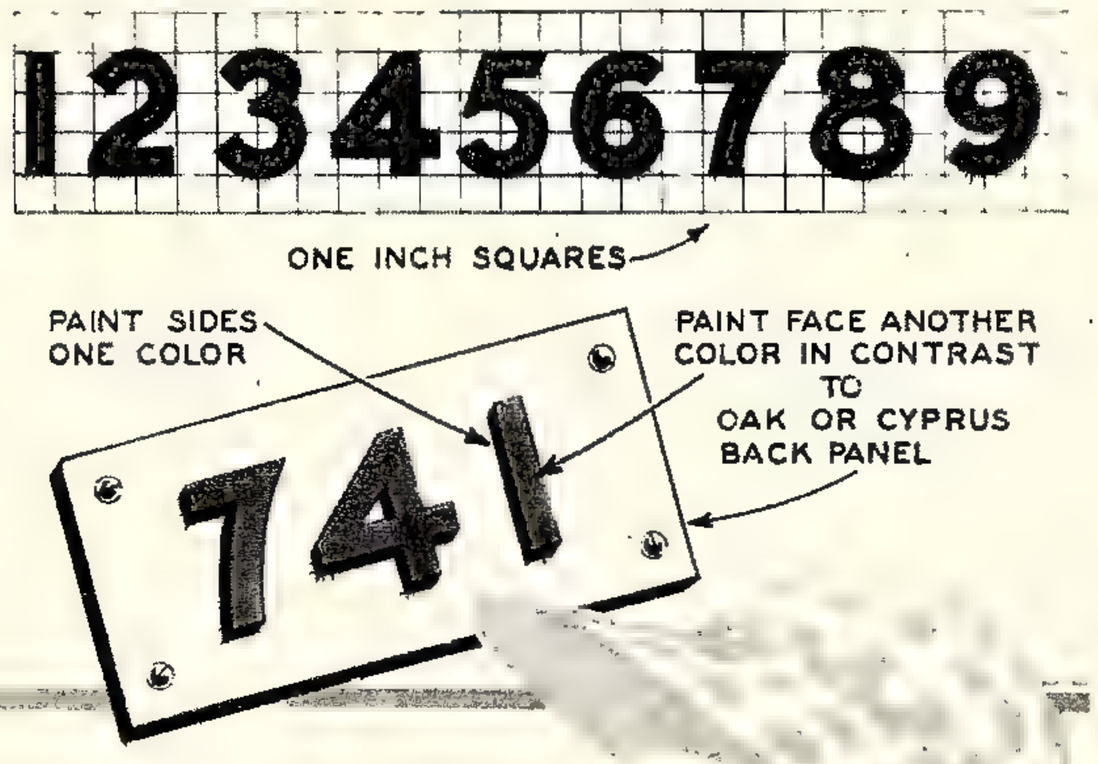
to take the stencil and the numbering done with a stub brush dipped in paint or enamel of the right color. A circular hole is cut in a sheet of heavy paper and held against the step and the exposed portion painted white. Then after the paint dries, the number stencil was held over this and painted in. The effect can be reversed by painting the rectangular area black and the numbers painted on this background in white. At best, painted numbers are good for only a season or two and unless artistically done, are not generally satisfactory.

An interesting example of cutout numbers are shown in the photograph of the gate. To begin with, the location is logical because the eye is easily drawn to the novelty gate. Following the curve of the top rail of the gate, the numbers are gracefully placed. These numbers were cut from hardwood ⅜-inch thick and double dipped in enamel before placing. Then the brad heads were touched with white to cover them.

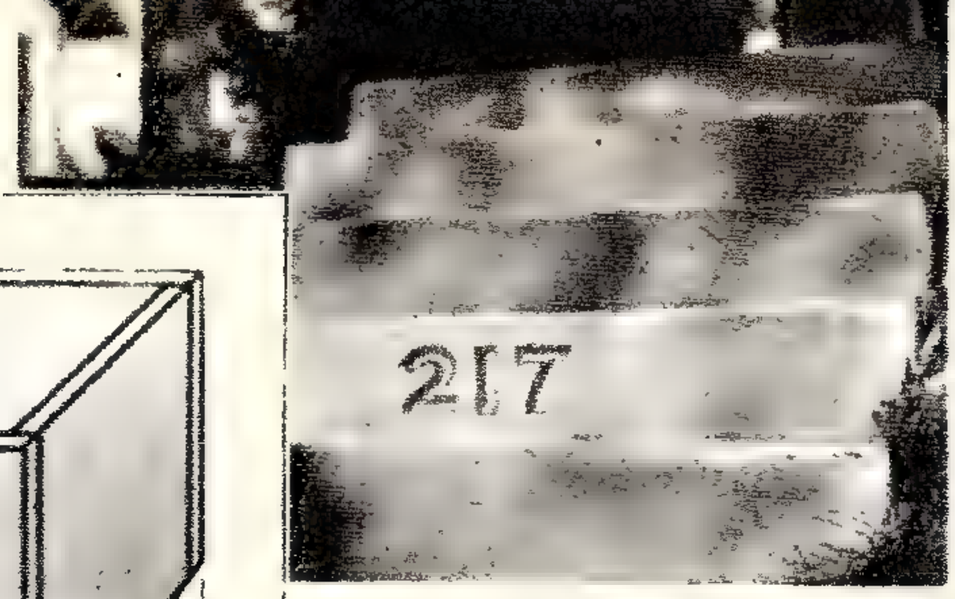
Cutout numbers can be mounted on a wood plaque which in turn is fastened to the roughly stuccoed wall. A neat effect results. The numbers are fastened to the plaque with brass screws after plaque and numbers are double painted. An interesting possibility of the wood cutout numbers is the third dimension which makes them more easily seen, particularly when slanting shadows bring them into prominent relief. Another way to accentuate this relief effect is to paint the

A small wooden plaque with numbers mounted on it is an attractive fixture which can be fastened to a concrete or stone wall. The numbers should be large enough to be seen from a reasonable distance.

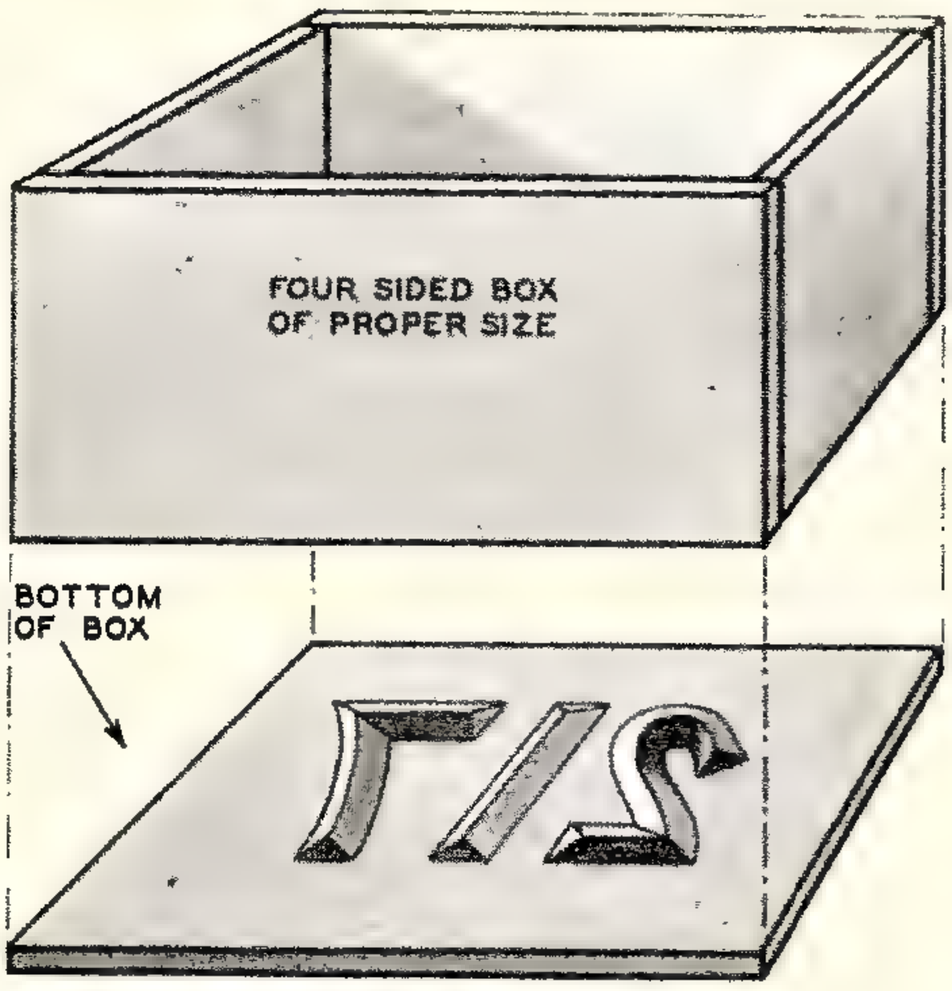
Some persons prefer to use names instead of the more conventional numbers. Metal is good material to use, as it can be taken down when moving, and put up again at a new location.



NO NEED SLEUTHING FOR HOUSE NUMBERS WHEN PLAIN, HEAVY, CUT-OUT OR PAINTED-ON NUMERALS ARE USED..



Numbers can be indented into a concrete block which can be set into a step, makes a lasting arrangement. Before pouring concrete, coat the wooden numerals with a layer of oil.

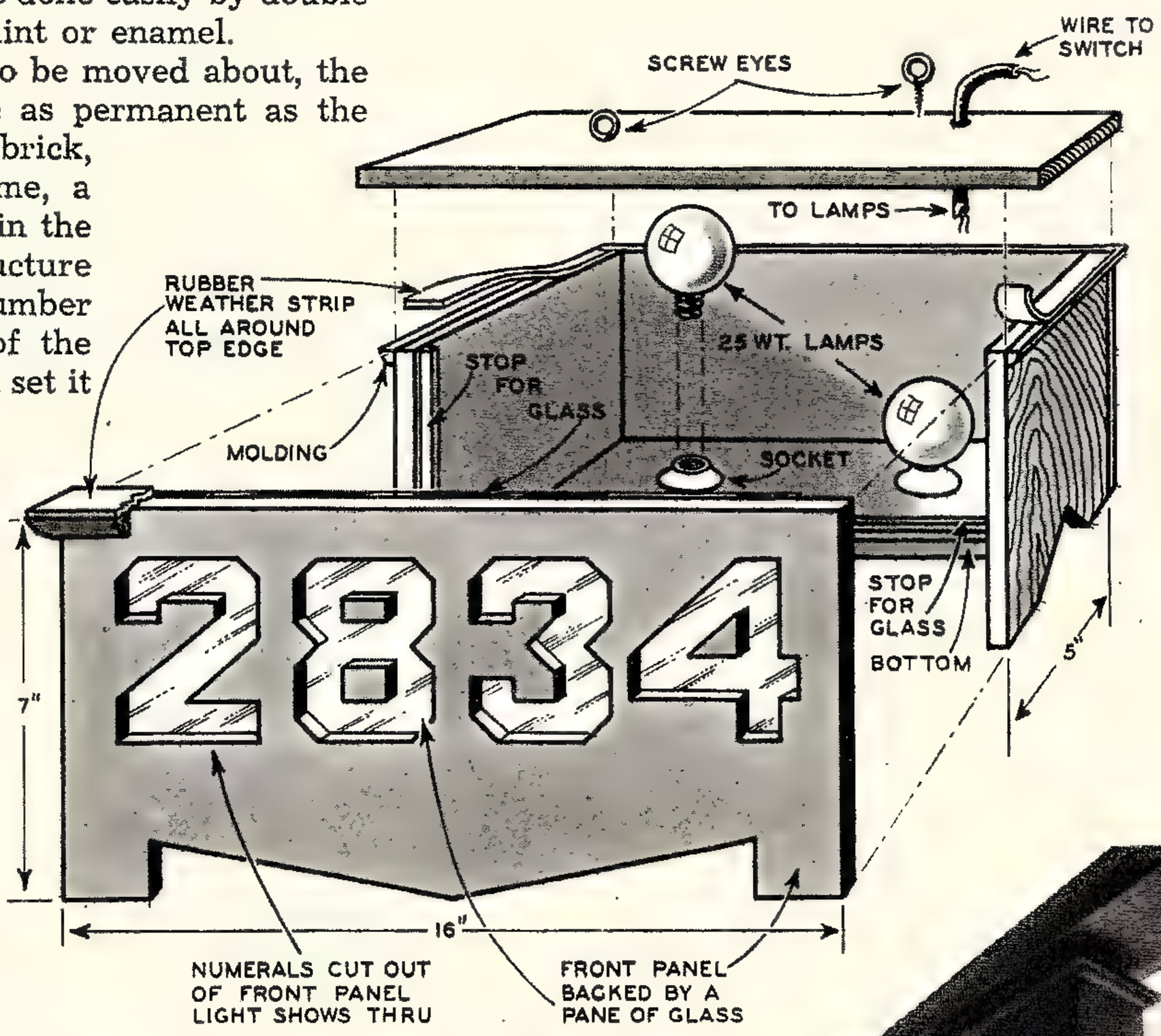


NUMBERS CUT FROM WOOD, BEVELED OR ROUNDED AND TACKED TO BOTTOM. NOTE THAT NUMERALS ARE PUT DOWN IN REVERSE ORDER AND BACKWARDS. . . . . .

faces of the numbers one color and the sides another. Wood number cutouts will remain free from cracks for years when cut from a tough wood such as red gum or cypress. If the numbers are fastened to the plaque with screws or brads and glue, the possibility of splitting or checking will be lessened. The chief method of insuring endurance however, is to seal thoroughly the wood fibers against moisture, which can be done easily by double or triple dipping in paint or enamel.

Since a home isn't to be moved about, the house number can be as permanent as the foundation. For the brick, stone or concrete home, a good method of tying in the number with the structure itself is to cast that number in a concrete block of the proper dimensions and set it right in the wall. The block may be natural gray which results when concrete is mixed. White or any one of many colors can be mixed in with the aggregate before adding the water to achieve a tint or color in harmony with the color scheme of the building. The block, when cast, should be of a size which will fit into the wall without breaking design or mortar joints. The first step is to choose the style of numbers to be used, then cut these from wood in reverse and fasten them, properly spaced to the box's bottom as the sketch shows. This done, the box is filled with the mortar, well spaded to remove air bubbles, then kept covered and wet until the proper time for removal. Such

[*Continued on page* 136]

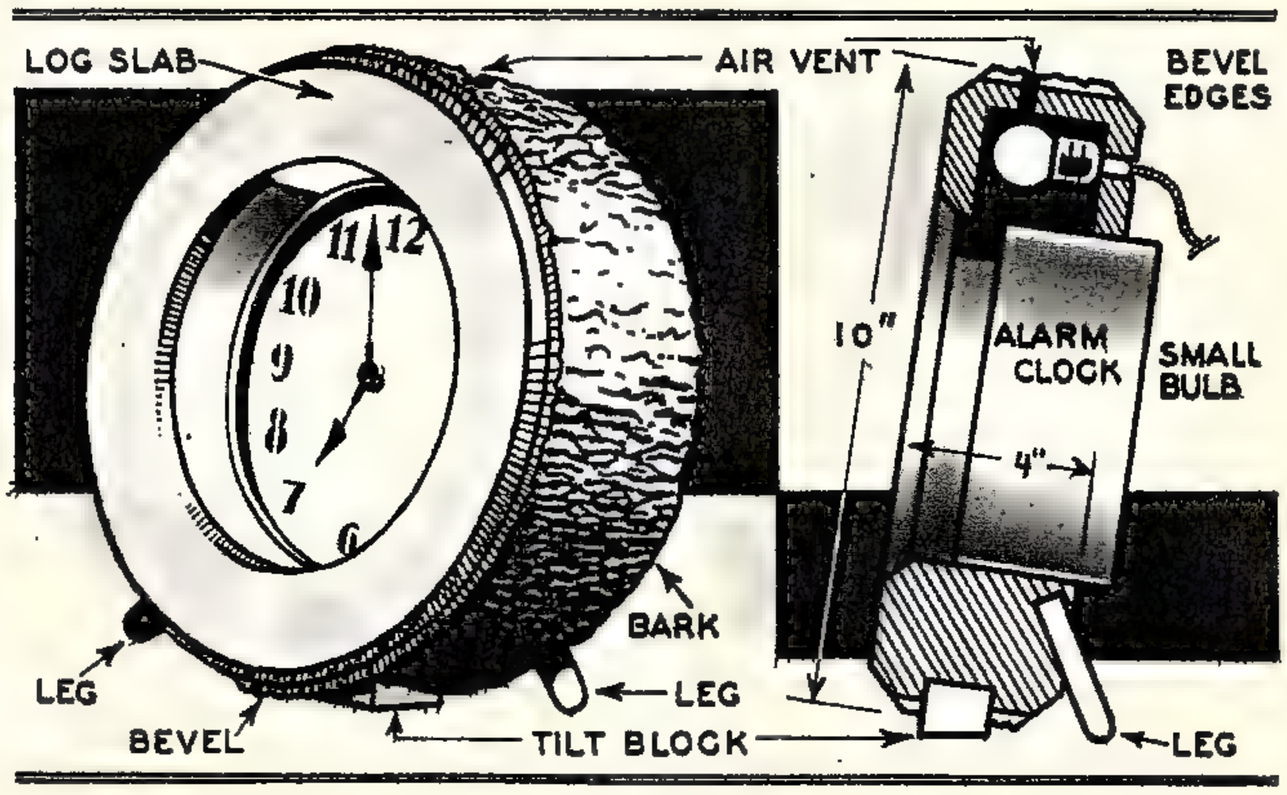


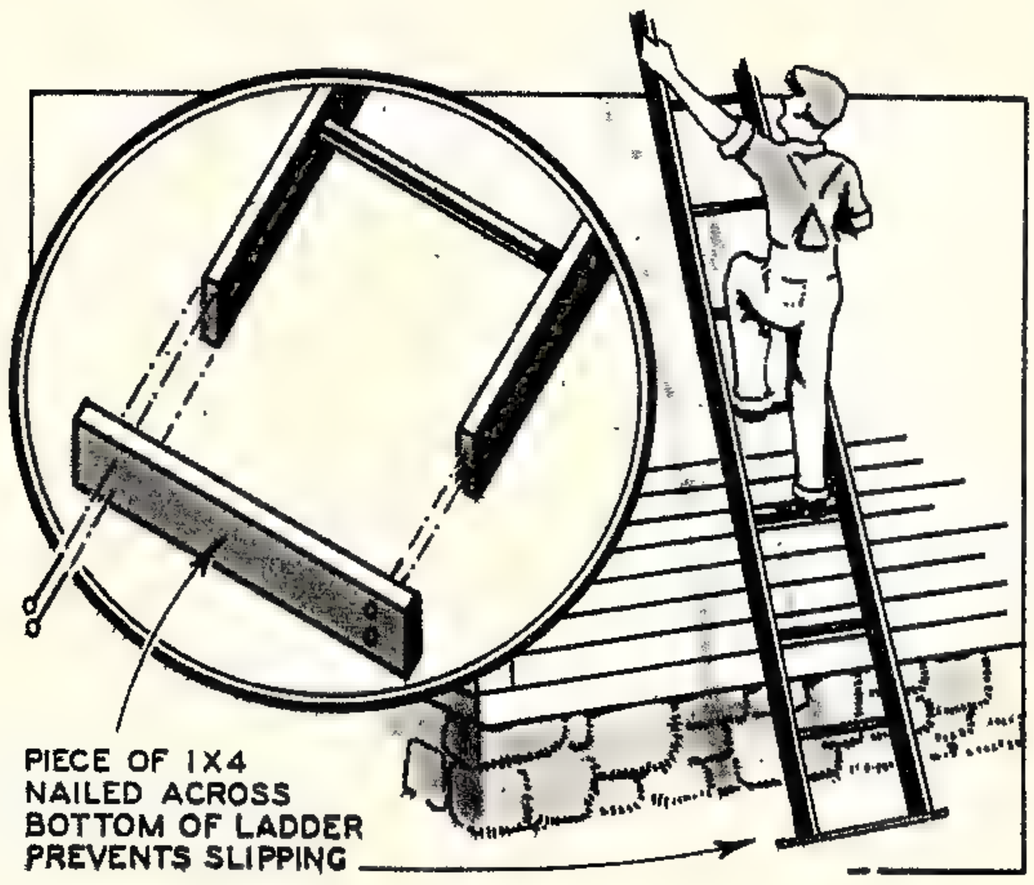
The arrangement shown above makes the house numbers visible for a considerable distance during the night, when numbers are hardest to read. The numerals are cut out of the front panel so that the light will shine through. The cut out panel should be backed by a piece of glass.

Kinks Simplify Household Tasks

Log Dresses Up Clock

A LOG slab, an old alarm clock, light socket and bulb make up this attractive rustic clock for a den or mantel. The slab should be about four inches thick. The front face should be turned on a lathe, with a bevel cut around the outer edge. A small space should be left between the face of the clock and the front of the bulb compartment so that light will reach the numerals.—G. E. Van Horn.



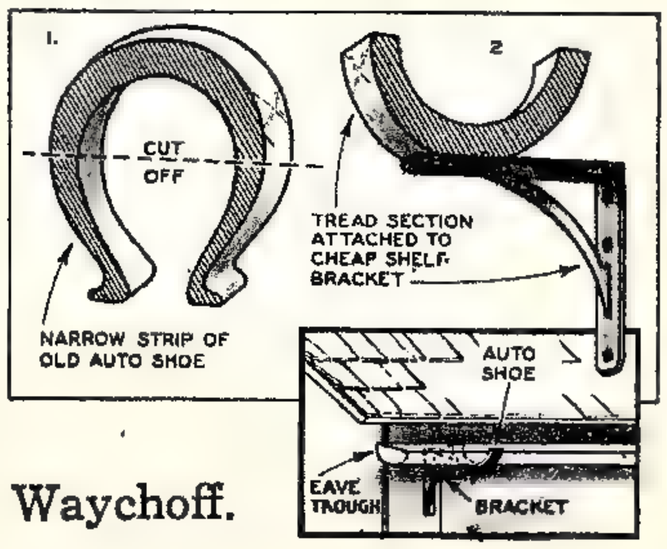


Board Improves Ladder Use

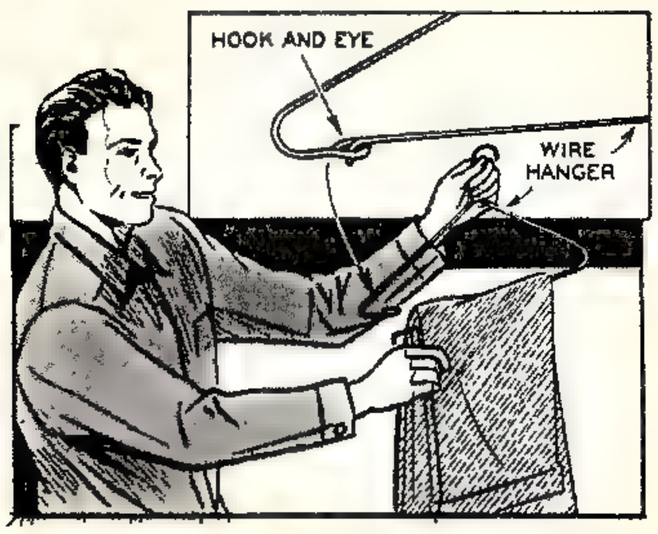
MUCH of the danger of working on ladders can be eliminated by fastening a short length of board across the bottom. This prevents the ladder from sliding away from the wall, and also prevents one side from sinking in the ground. When the ground is muddy this problem becomes particularly acute, and unless both ladder feet are placed on something solid, working on the ladder becomes dangerous. If a 4 by 1 inch board is nailed across the feet as shown in the drawing enough surface will be presented to the ground to prevent much settling. If short nails are used, the board can be taken off the ladder easily and quickly when not needed.—A. H. Waychoff.

Tire Strips Become Trough Support

WHEN the ordinary type of eave trough support does not have sufficient strength, the type shown at the right will make a sturdy substitute. To make them, fasten strips of old auto tire casings to stamped metal shelf brackets. The casing strips should be cut approximately in half so that the trough will fit in it easily and securely. The supports should be placed about five or six feet apart.—A. H. Waychoff.



Hook And Eye Improves Coat Hanger



ORDINARY wire coat hangers can be improved considerably when they are used for holding trousers by adding a hook and eye to the bottom as shown in the drawing at the left. When trousers are to be hung from it, the support is opened and they can be slid on. After the hook and eye are bent, the edges should be rounded off with a small file, to prevent catching on to the cloth as it slides on or off.

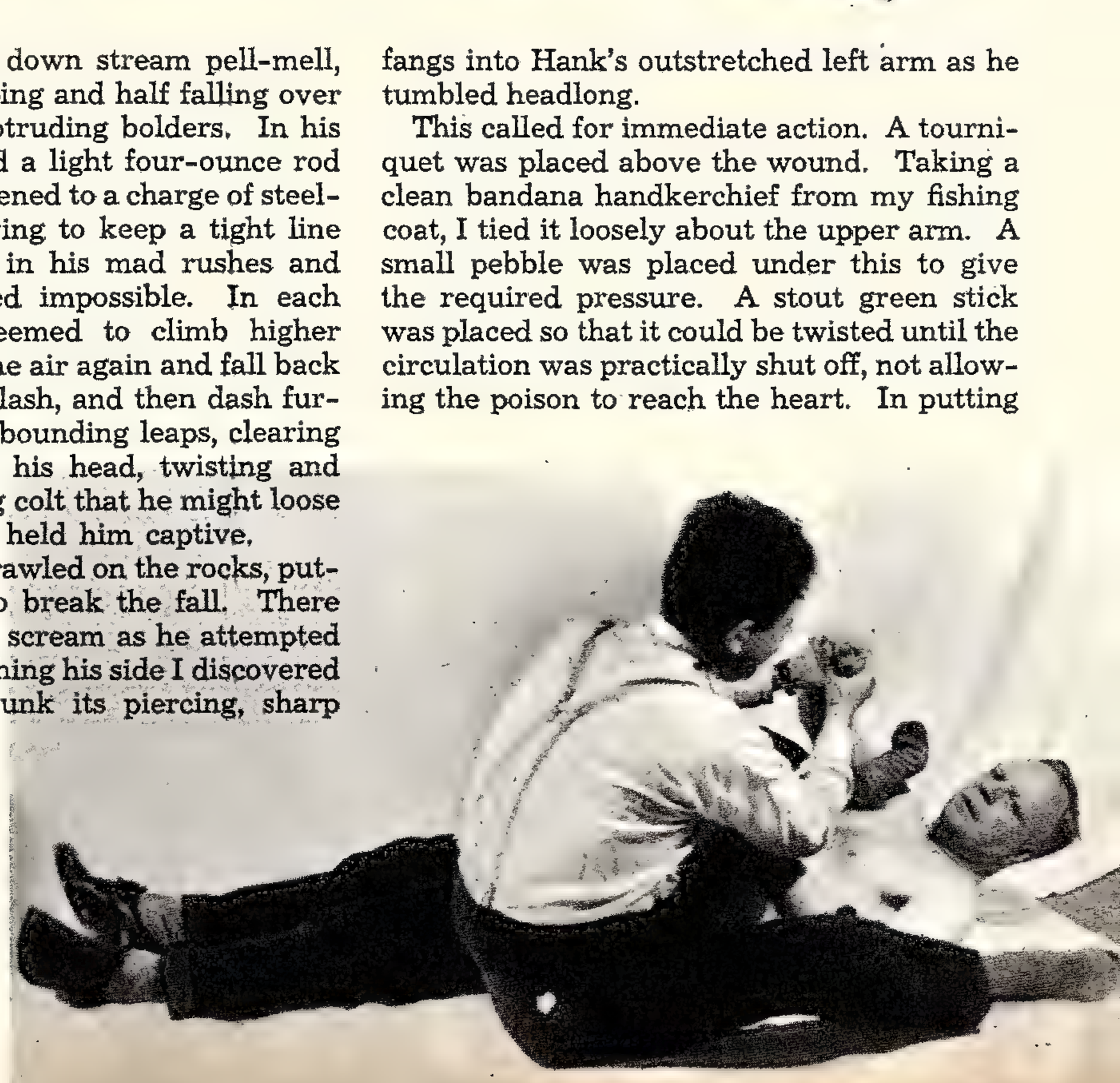
FIRST AID

Every camper should include a first aid kit as an important part of his equipment. This unique kit compactly fits into an ordinary tobacco can.

HANK was going down stream pell-mell, stumbling, tripping and half falling over jagged rocks and protruding bolders. In his right hand he carried a light four-ounce rod and line securely fastened to a charge of steelhead dynamite. Trying to keep a tight line on this wild demon in his mad rushes and aerial attacks seemed impossible. In each zooming rush he seemed to climb higher only to tumble into the air again and fall back with a resounding splash, and then dash further down stream in bounding leaps, clearing the surface, shaking his head, twisting and prancing like a young colt that he might loose the sharp barbs that held him captive.

Suddenly Hank sprawled on the rocks, putting his hands out to break the fall. There was a wild agonizing scream as he attempted to gain his feet. Reaching his side I discovered that a rattler had sunk its piercing, sharp fangs into Hank's outstretched left arm as he tumbled headlong.

This called for immediate action. A tourniquet was placed above the wound. Taking a clean bandana handkerchief from my fishing coat, I tied it loosely about the upper arm. A small pebble was placed under this to give the required pressure. A stout green stick was placed so that it could be twisted until the circulation was practically shut off, not allowing the poison to reach the heart. In putting



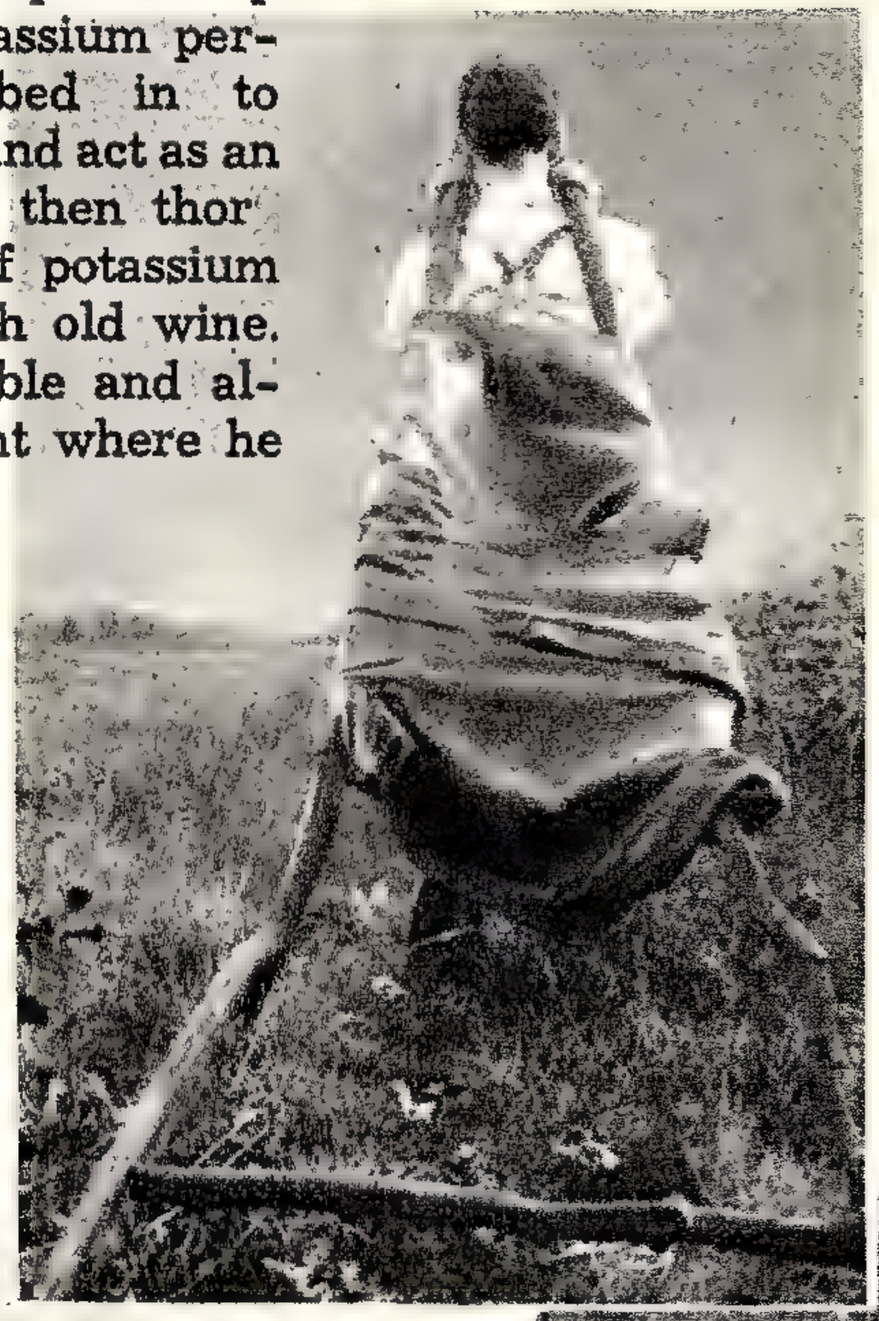
To reset a dislocated shoulder, remove patient's clothing to the waist, place your bare heel in his arm pit, then grasp his hand and turn well in toward center of body. Some force may be necessary before it will go back into place.

For The SPORTSMAN

By Dr. C. W. Clifford

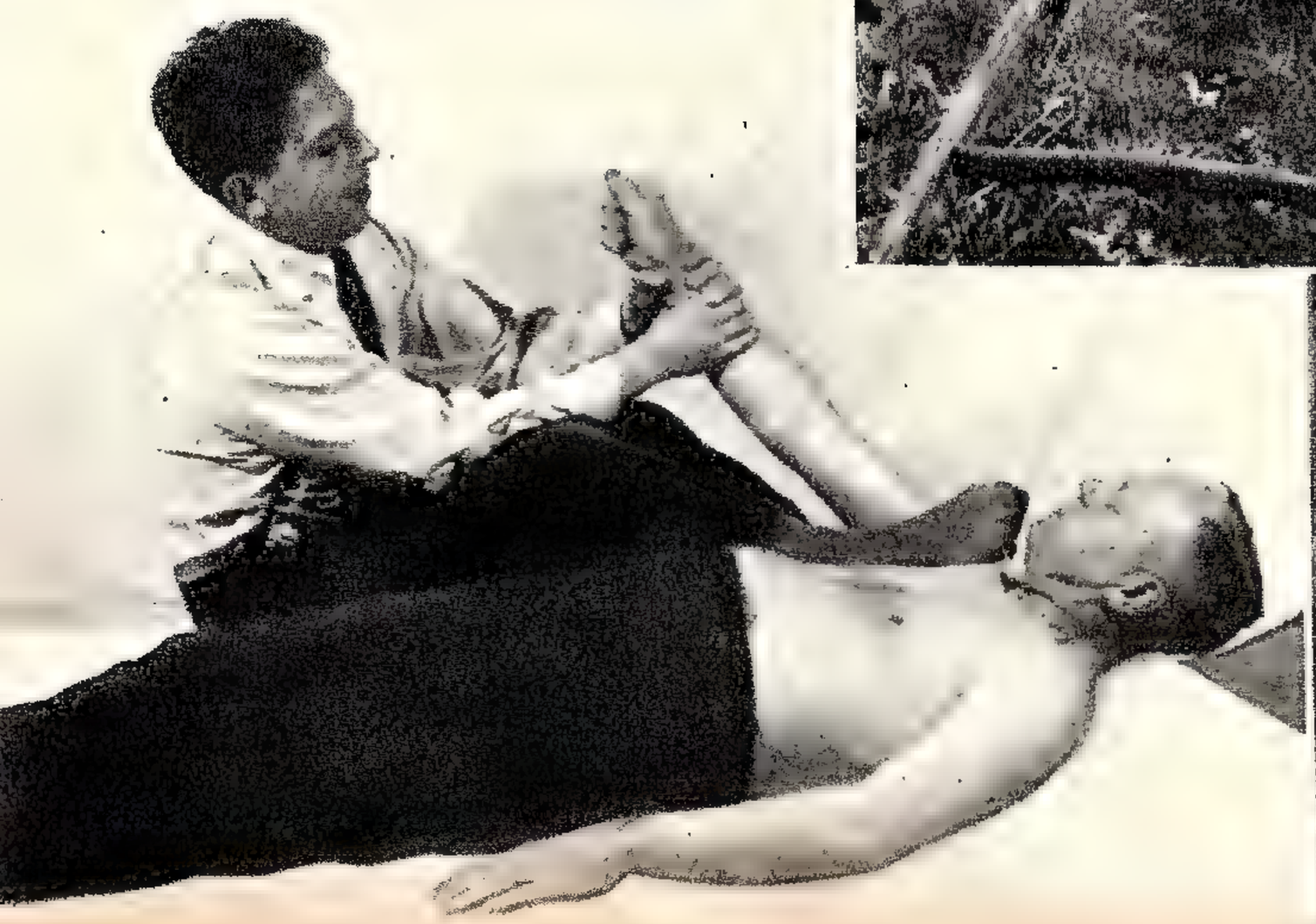
on a tourniquet one must always remember that it should be applied between the wound and the heart. With the small blade of my pocket knife I made incisions ¼-inch deep to let out the poison. The wounds were then sucked to draw out the poison. In doing this I was sure there were no abrasions in my mouth to let in the poison. I kept this up several minutes, after which potassium permanganate crystals were rubbed in to counteract any remaining poison and act as an antiseptic. My own mouth was then thoroughly rinsed with a solution of potassium permanganate the color of a rich old wine. The patient was made comfortable and allowed to rest for some time right where he was. This quiet rest is essential to keep down any unnecessary work on the heart.

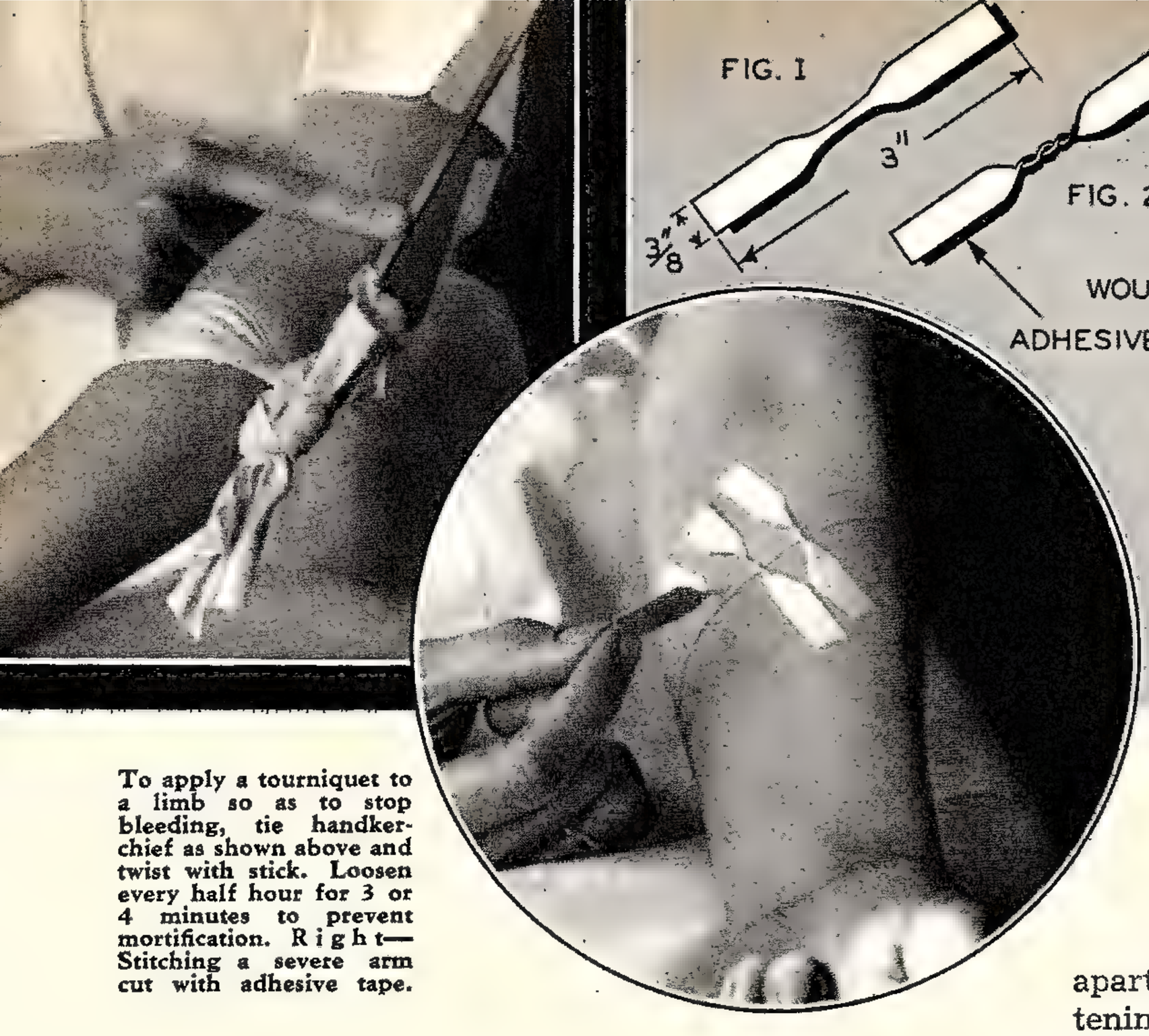
The tourniquet was loosened for three or four minutes every half hour to prevent ultimate loss of the arm by mortification. Anti-venom given according to directions brought the patient around in good shape. It is well



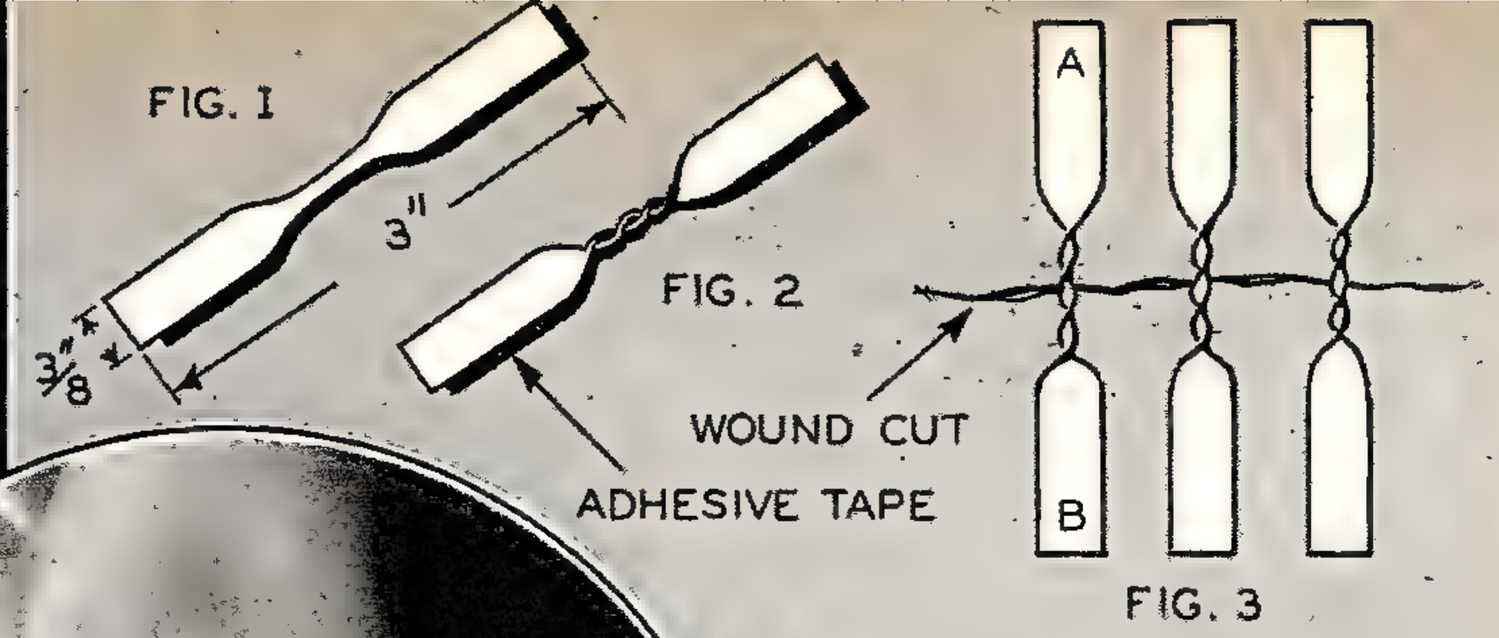
Below—If a bone of the arm or leg is badly fractured a strong pull, with heel in arm pit, will be necessary to keep it straight. Keep the bones rigid with splints and bandage; then take patient to doctor at once for medical attention.

A one-man stretcher for carrying an injured person out of the woods can be made from two poles and a coat. Turn sleeves inside out, run poles through them and button up. Place patient on stretcher with his head resting forward.





To apply a tourniquet to a limb so as to stop bleeding, tie handkerchief as shown above and twist with stick. Loosen every half hour for 3 or 4 minutes to prevent mortification. Right—Stitching a severe arm cut with adhesive tape.



If ready made adhesive stitching tapes are not available, they can be very easily made from 3/8-inch roll tape. Cut the tape first as shown in Fig. 1, then twist to give it strength as in Fig. 2.

to be prepared with a kit of this if you plan on going into a snake country. It will fit easily into your coat pocket, and so, is handy to carry. When you do not have this serum available it should be given as soon as it can be secured.

Did you ever stop to think that this might happen to you? Maybe someone else in your party gets hurt or bitten, breaks a leg, dislocates a shoulder or just gets sick. Physicians are not always close at hand when needed, especially if a mishap occurs far from the beaten path. In such cases it is necessary that every one who plans a trip that will take him far afield have some knowledge of what to do.

A fracture can be told by the symptoms which soon develop. There is loss of power, pain, swelling and the limb is out of its usual alignment. Set it by getting the broken ends together. A strong pull on the arm or leg, with your bare foot in the armpit or crotch, is usually necessary as the muscles have contracted and forced the stumps past each other. Hold the parts with a splint of cedar or other bark over a packing of anything soft such as a handkerchief and dry moss. Tie the bark on and if an arm put it in a triangular sling so that it will not hang down. A triangular sling is easily made from a big handkerchief and held up with a safety pin.

If it is a broken leg, you must get him out of the woods. Cut or find two poles about 15 feet long. With your coats make a carry by turning the sleeves in and putting the poles through. Button the coats up with the buttons down. Hold the poles apart with crotched sticks, fastening one end of each stick with your fish line. Place the patient on this stretcher with his head toward you, pick up an end of each pole as you stand between them and walk off with your burden letting the ends drag on the ground.

A sprained ankle on a fishing or hunting trip is quite common. It calls for cold packs for the first 24 hours. Cold towels from the coldest water you can get and changed every few minutes are next best to an ice pack to relieve pain and keep down swelling. Cold packs continuously applied produce a definite local anaesthesia and causes a temporary inhibition of inflammation in its early stages. It reduces the volume of the parts by lowering the temperature, contracting the vessels and tissues. (When you get home have it X-rayed; very often a bone is broken.) After twenty-four hours wet heat may be applied. A towel soaked in hot water and applied will increase the osmotic pressure, increasing the flow of lymph and carry away the products of the early stages of inflammation, pouring them into the blood stream to be disposed of.

Severe bleeding may come from either an artery or vein. If from an artery it will be bright red in color and come in spurts. If a large artery or vein is cut the tourniquet will stop it. In an emergency a shirt sleeve may save a life; don't hesitate, but act at once. In the case of ordinary cuts and where the bleeding is only moderate, use the surgical dressing. That is, cover with iodoform gauze; then hold in place with a bandage and fasten with adhesive tape. A long gash or

cut may call for stitching. In amateur hands use the adhesive tape method; it is simple and quite efficient.

Cut strips of adhesive 3 inches long and ⅜ inches wide—then cut in center portion as shown. Twist the strips in opposite directions until they become thread-like in the center. Place end "A" on tissue, pull the edges of the wound together, then secure with end "B." Cover with surgical dressing.

Burns and scalds are an unpleasant occurrence on any trip and should be treated immediately. For simple burns picric acid ointment in tube form is very convenient and stops the pain at once. For the small kit put a little in a tin box and leave the big tube in the car. Tannic acid for the more severe burns and scalds is to be recommended. Make a 2% to 5% solution. For the small kit I carry 36 grains in a small bottle that measures ¾ inches in diameter and is 3¼ inches long.

This size bottle will just hold it and when it is put in 4 ounces (a glass full) of boiling water it makes a 2% solution. Soak the sterile gauze in this and put on a wet compress. The area should be kept covered with this wet dressing for from 36 to 48 hours or until the coagulum has formed. Medical care is advised as soon as possible. Don't use grease or fats of any kind! If they have been used remove them and follow the treatment above. Tea contains tannic acid. As a substitute make a pot of it ten times normal strength and use it as the wet dressing.

Every sportsman should have in his car or camp complete first aid equipment. There should be a small supply of medicines, antiseptics, a strychnine unit, plain and iodoform gauze, medicated cotton and cotton applicators, scissors and lance.

The medicines should include compound cathartic (CC-tablets); anacin tablets for headache; iodine for cuts, bruises and abrasions of the skin; aromatic spirits of ammonia is a restorative in cases of fainting or fatigue; mentholatum for chapped or cracked lips, insect bites and small abrasions and potassium permanganate crystals for snake bite. Three or four crystals dissolved in a glass of warm water makes a good mouth wash. It makes a good wash for infected wounds also. Just make it a good pink color; only a few crystals are needed.

Add the following and you have a useful small kit that fits into a tobacco can: 1 small scissors, 1 small tweezers, 3 small envelopes with gauze and cotton applicators, 1 roll ½-inch adhesive tape, 1 roll ½-inch bandage, 1 small bottle alcohol.

Although the value of intelligently administered first aid cannot be over estimated, no attempt should be made to have it take the place of treatment by a physician. For any injury showing the slightest signs of seriousness, professional treatment should be obtained just as soon as possible, even at the risk of spoiling a vacation. Remember that it is far more important to lose a few days of a trip than to risk serious trouble or death.

Many persons overlook the danger of small scratches, cuts, and abrasions, and take no precautions against infection. A minute or two spent in swabbing some iodine over a cut may prevent hours of suffering.

Below—Cover a wound with a pad of plain or iodiform sterile gauze and hold it in position with a piece of rolled bandage. Secure the bandage with adhesive tape.

Right—To support a broken arm that has been placed in splints, make a triangular sling from a large handkerchief, bed sheet or clean white shirt.

Above—A front view showing the position of the two controls. If a smaller dial is used for the tuning control (C), the panel size can be reduced. Right—The rear view of the receiver shows the simple arrangement of the parts. Metal construction is used throughout.

THE simplest short-wave receiver that is capable of giving good results consists of one or two tubes with regeneration. Thousands of such receivers have been described in the past; they differ from one another mainly in the manner in which the tuned circuits are arranged and in the manner in which regeneration is obtained. The familiar tickler or capacity-feedback circuits are good, but somewhat tricky, in that extreme care in the design of the feedback circuit is necessary to obtain smooth control of regeneration.

The one-tube receiver described in this article has several advantages which have not been described in the past. First, there is no tickler or capacity feedback circuit; the familiar tickler is replaced by a tube, and regeneration is controlled by varying the r.f. input to the tube. Second, the same tube that is used as a "tickler" also is an audio amplifier, so that more than usual amplification is obtained. Third, one of the new twin triodes is employed, so that all the functions have been combined into a single-tube set.

The diagram of the receiver is shown in Fig. 1. Coil L and condenser C tune in the signal, which is fed to the detector triode, T1, which is one-half of a 6F8G tube. The output of T1 appears across R2 and R3 in series, and is applied to T2, which is the second half of the 6F8G. The output of T2 passes through the phones and back to the input coil and condenser. Now, R3 is bypassed, so that only the r.f. voltage across R2 is applied to T2. And since the phones are bypassed, the amplified r.f. signal is applied back to the grid of the first tube. Thus, regeneration is obtained and is controlled by the potentiometer R2. But T1 is a detector, and the audio part of the output appears across R3 and is applied to T2, amplified, and heard in the phones. This audio is not applied to T1, because the grid circuit of T1 is a radio-frequency circuit. T1 and T2 have been drawn separately only because of convenience. It is evident that regeneration is obtained without any tickler or trick circuits; T2 is both the feedback circuit and the audio amplifier.

A simple power supply unit for the Regenoflex is shown in Fig. 2. It consists of a power transformer, an 80 rectifier, two filter condensers, a choke, and a bleeder resistor. The values are given in the list of parts. If the power supply unit and chassis are built as separate units, only two wires are required to connect them, the ground wire and the B plus.

It is not essential that a power supply unit be used. When a storage battery is available to light the heater of the 6F8G, then 135 volts of "B" batteries is suitable.

Socket connections for the 6F8G are shown in Fig. 3. The socket is of the octal-base

TWIN TRIODE REGENOFLEX

by B. L. Goldring

One tube gives two-tube operation in this compact radio receiver.

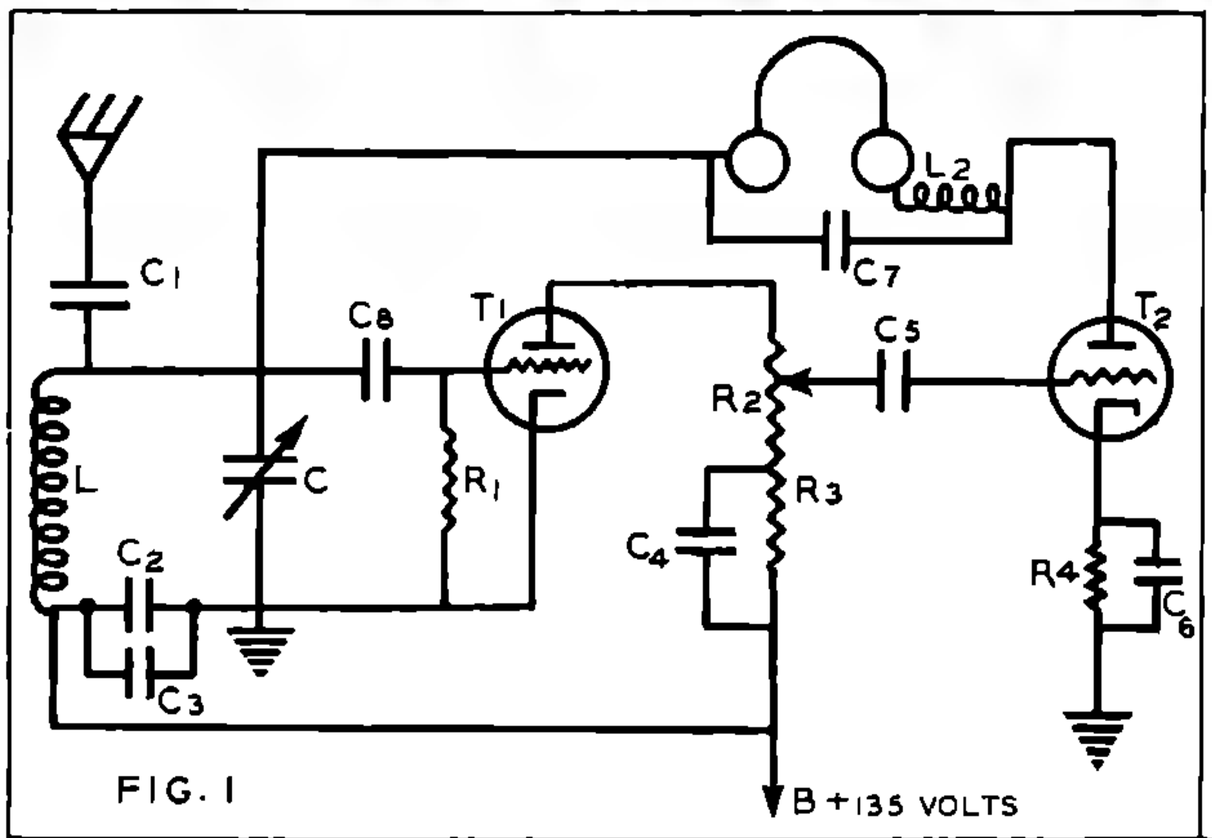


FIG. 1

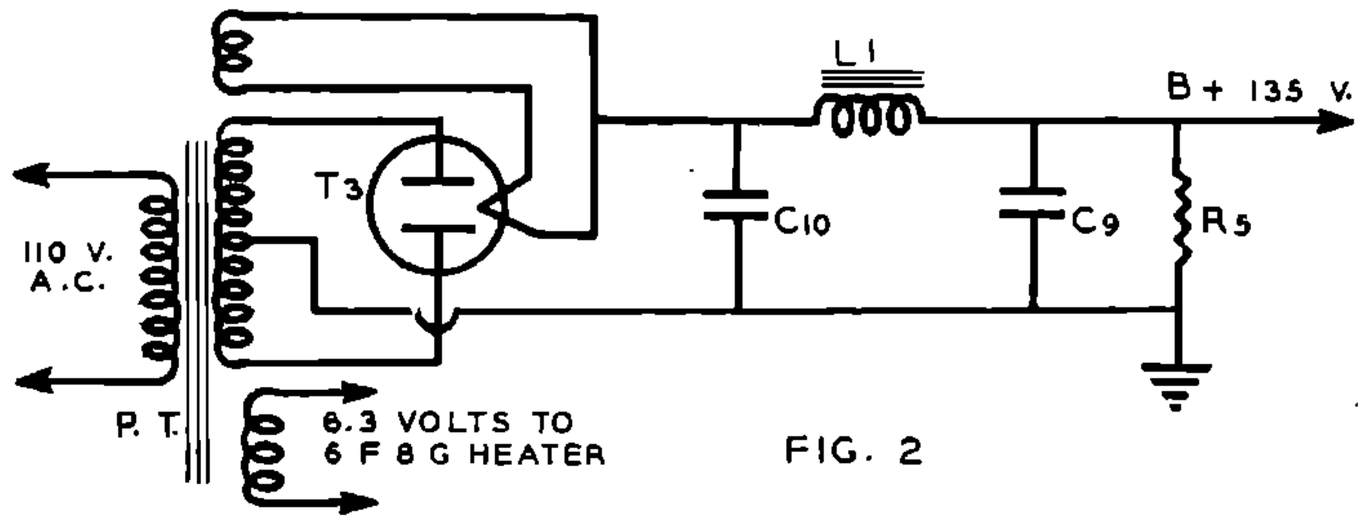


FIG. 2

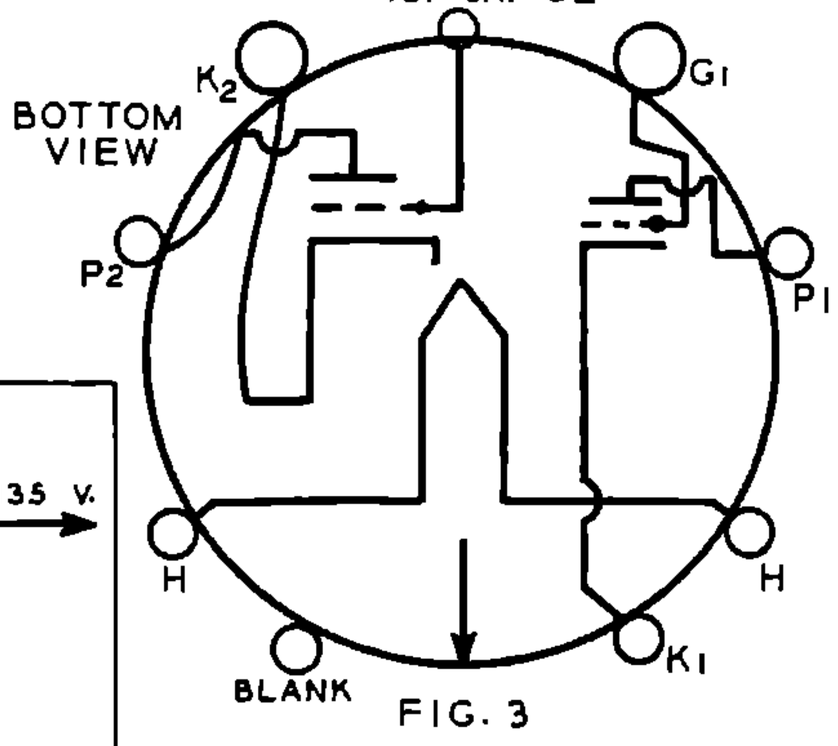


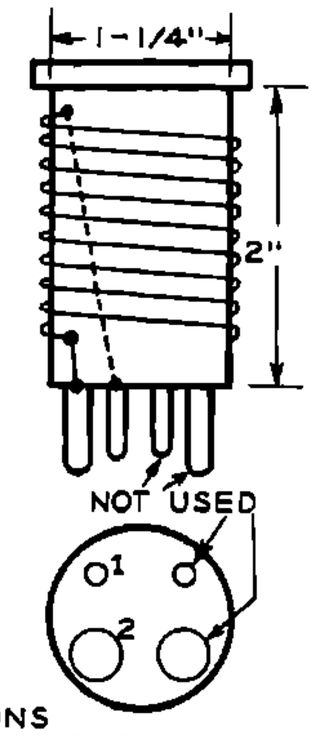
FIG. 3

Although the diagram shows two tubes, actually they are duplicate elements enclosed by one glass envelope. If a storage battery is available for supplying filament power, B batteries can be substituted for 110-volt power supply.

WAVE BAND METERS	NO. TURNS	WIRE SIZES	TURNS PER INCH
10 – 20	4-3/4	NO.22 D.S.C.	8
20-40	10-3/4	NO. 22 D.S.C.	12
40-80	22-3/4	NO.22 D.S.C.	16
80-200	51-3/4	NO.28 D.S.C.	40
200-350	60-3/4	NO. 28 D.S.C.	CLOSE WOUND

COIL DATA

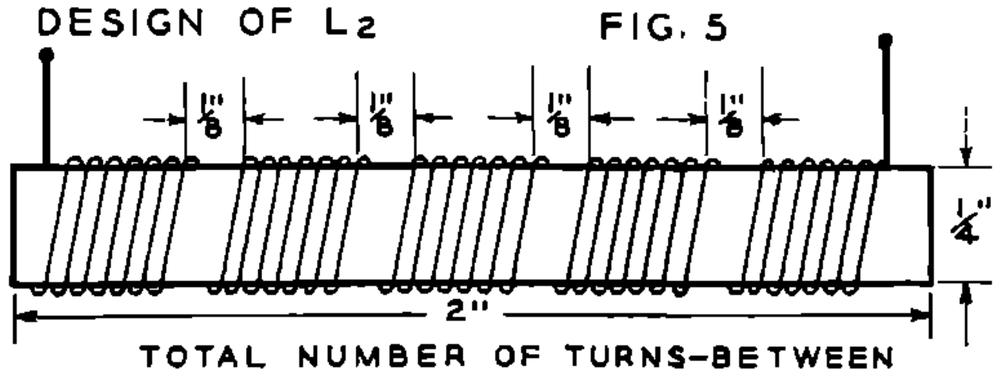
FIG. 4



SOCKET CONNECTIONS FOR COIL – TOP VIEW

DESIGN OF L_2

FIG. 5



TOTAL NUMBER OF TURNS–BETWEEN 50 AND 100 – IN EVEN SIZED PIES

is 6″x7″; it was made high enough to accommodate the large tuning dial. The arrangement of parts on the panel and on the chassis is clearly shown in the photographs. If a smaller tuning condenser and a smaller dial are available, the size of the receiver can be reduced.

Either section of the tube can be used for the input tube T1. Both have been tried and they work equally well. The section to use, then, depends entirely on the arrangement of the socket, the placement of antenna-ground posts, and the placement of the phone jacks. The rear-view photograph shows how these parts were arranged. The only rule to follow is to make the leads as short as possible.

The coils are particularly easy to construct.

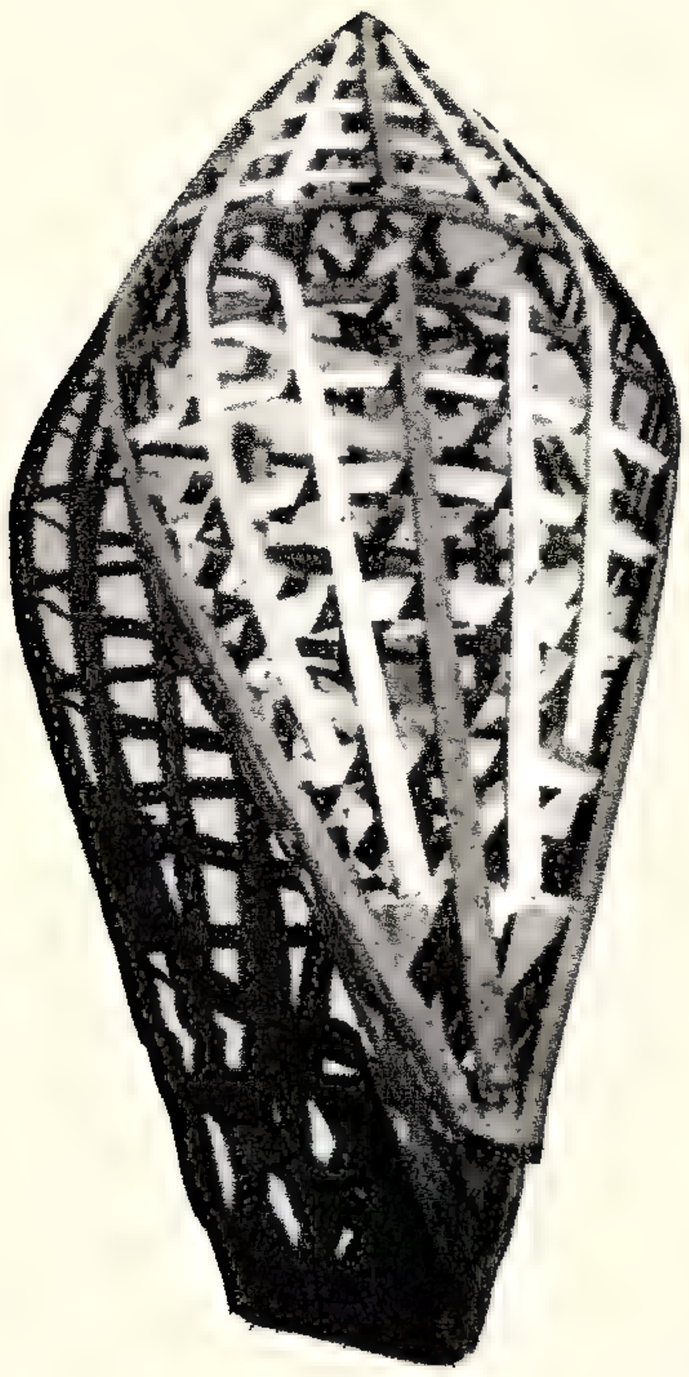
[*Continued on page* 134]

type, and the arrow on the sketch shows the position of the keyway in the center of the socket.

The receiver was constructed on an aluminum chassis 5″x6″x1⅞″. The aluminum panel

You radio fans and electrical experimenters are in for a treat if you read the September issue of MECHANIX ILLUSTRATED, because the neatest little gadget you ever saw will be described. It worked so well when we tried it in the office, and we found so many uses for it, that the editors all agreed that it should be called "The Magic Wire." Complete directions and drawings for building it are given, and most experimenters will find all the necessary parts right in the shop.

Build This Simplified Canvas



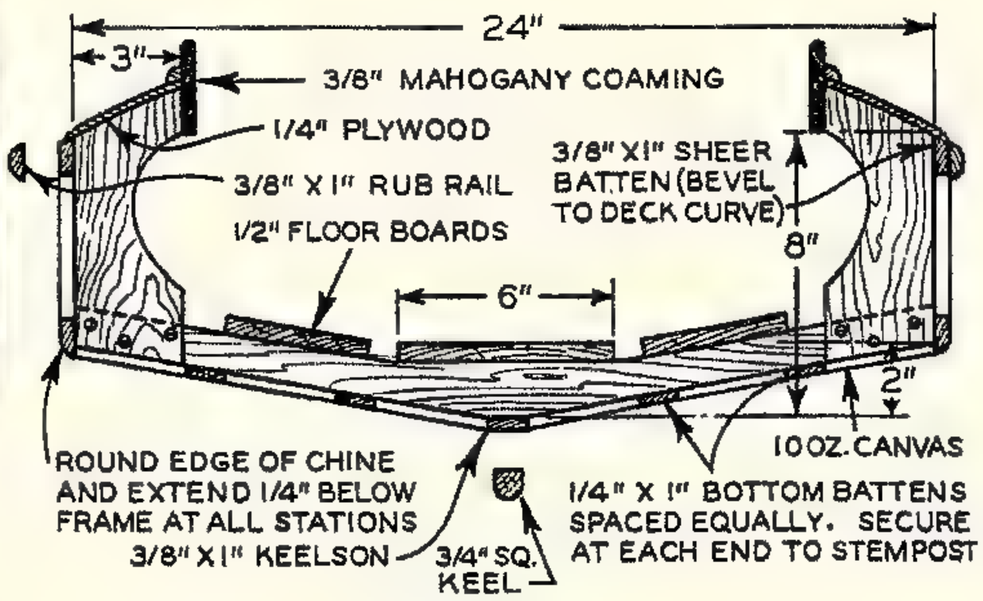
This photograph shows the kayak frame completed but not yet covered with water-proofed canvas.

TO ATTAIN maximum speed with minimum effort, most kayaks are built very long and extremely narrow, so that the lines actually resemble a toothpick. The narrow ones, however, are not easy for the amateur to handle. The one to be described is a much more stable type, having several inches more beam and not so much length. The weight and actual displacement compares favorably with the faster craft.

Throughout, this kayak is also designed for simplicity of construction, being identical at both ends, and the roomy cockpit exactly in the middle. Thus frames can be made in pairs, and are spaced the same distances apart. Stem and stern are exactly alike; this enables the passenger to paddle in either direction.

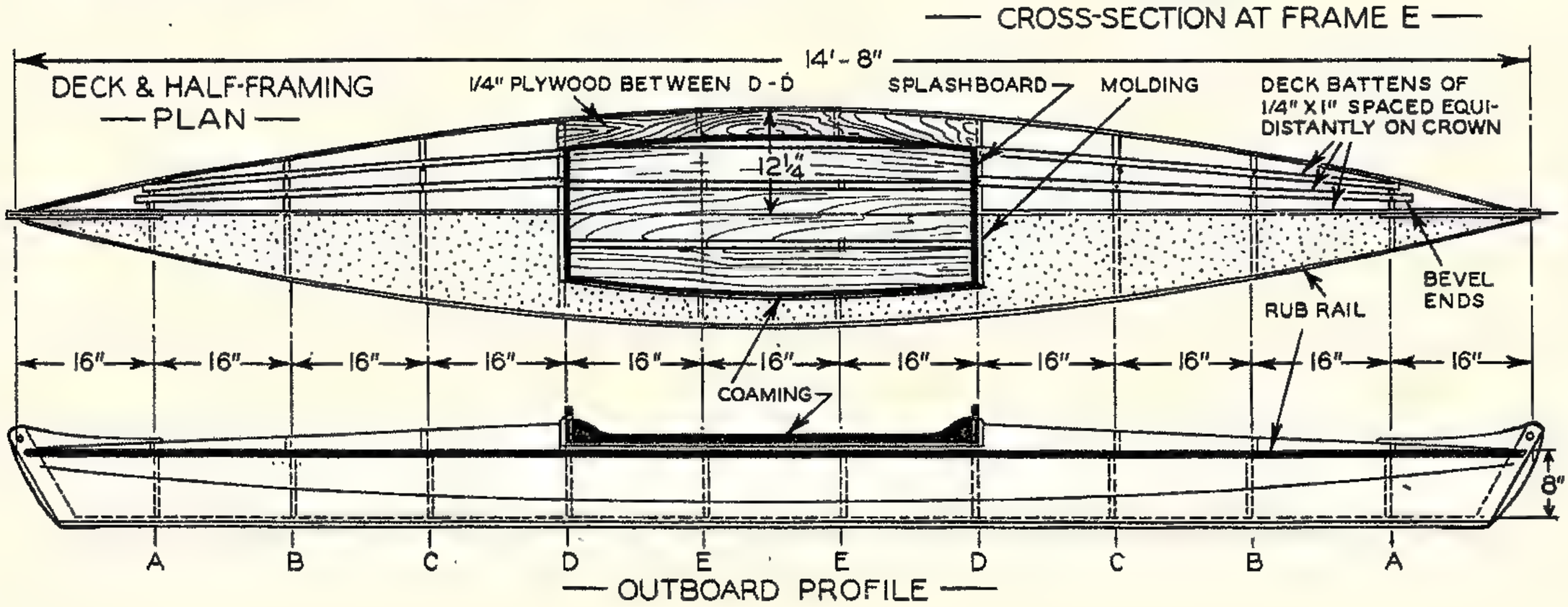
In narrow waters, or when one is in a hurry, it is not necessary to swing the craft around—not an easy task in limited space—instead, the passenger simply changes his position from one end of the cockpit to the other. This kayak, incidentally, will carry two comfortably.

The first step is to build the frames, two each of A, B, C, D and E, and the two stems. When completed, set a 14-foot plank on edge and brace in this position. Lay a batten, or keelson


24"
3"
3/8" MAHOGANY COAMING
1/4" PLYWOOD
3/8" X 1" RUB RAIL
1/2" FLOOR BOARDS
3/8" X 1" SHEER BATTEN (BEVEL TO DECK CURVE)
8"
6"
2"
10 OZ. CANVAS
ROUND EDGE OF CHINE AND EXTEND 1/4" BELOW FRAME AT ALL STATIONS
3/8" X 1" KEELSON
3/4" SQ. KEEL
1/4" X 1" BOTTOM BATTENS SPACED EQUALLY. SECURE AT EACH END TO STEMPOST

— CROSS-SECTION AT FRAME E —

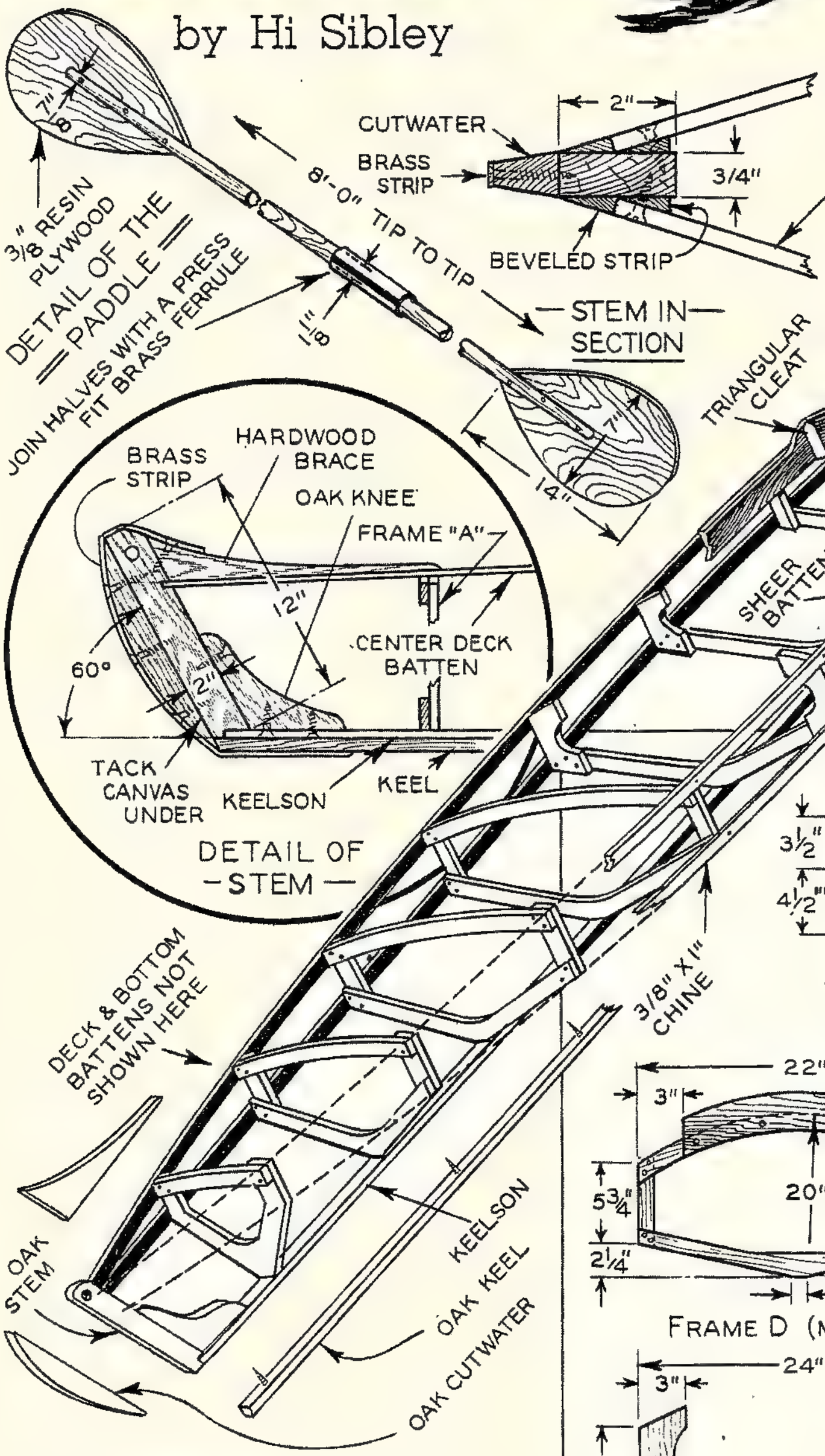
Right—Constructional details showing a cross-section at station E. Throughout, the kayak is designed for simplicity, being identical at both ends, with the cockpit in the center. The rectangular shaped cockpit makes construction considerably more simple for the beginner than the oval one.

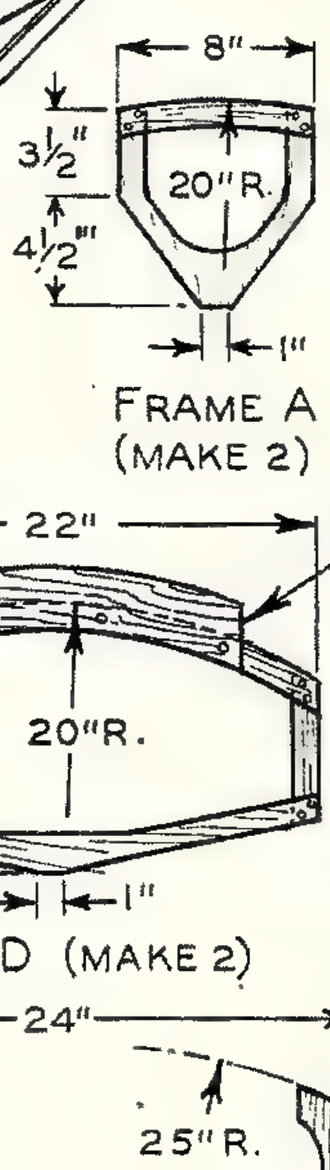


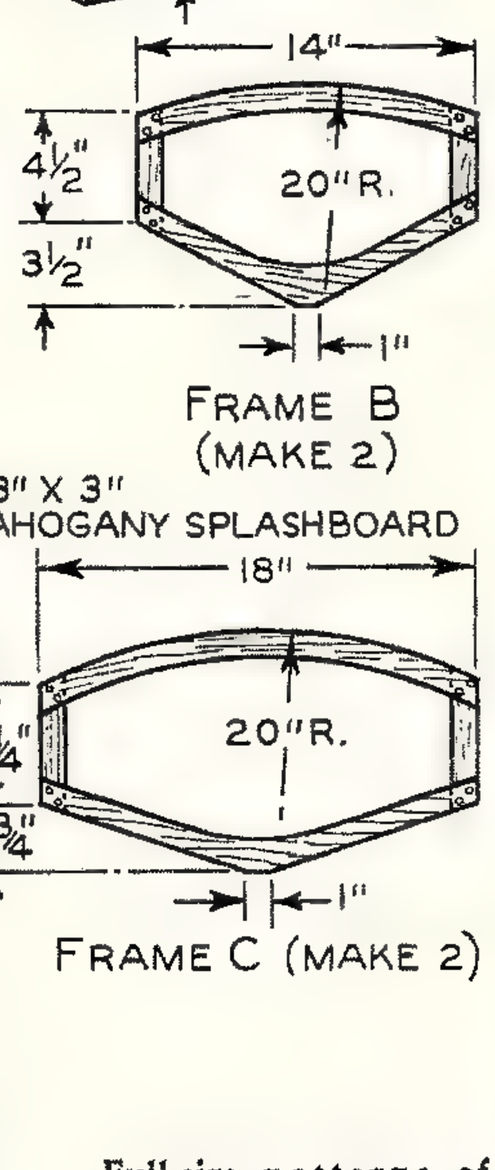
— OUTBOARD PROFILE —

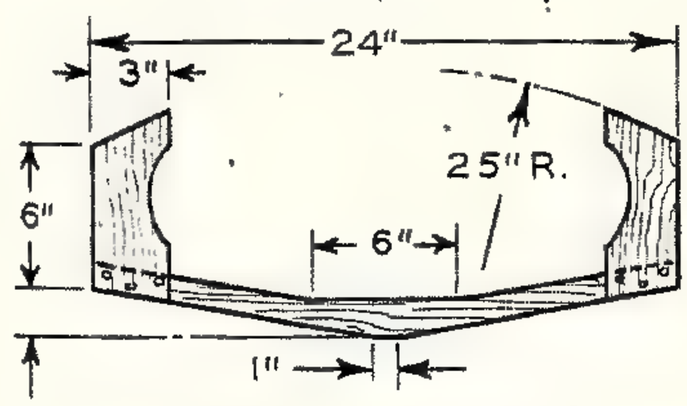
KAYAK

by Hi Sibley









Full-size patterns of each frame should be laid out before attempting to cut the lumber. Ten-ounce duck should be used for covering.

— FRAME PLANS —

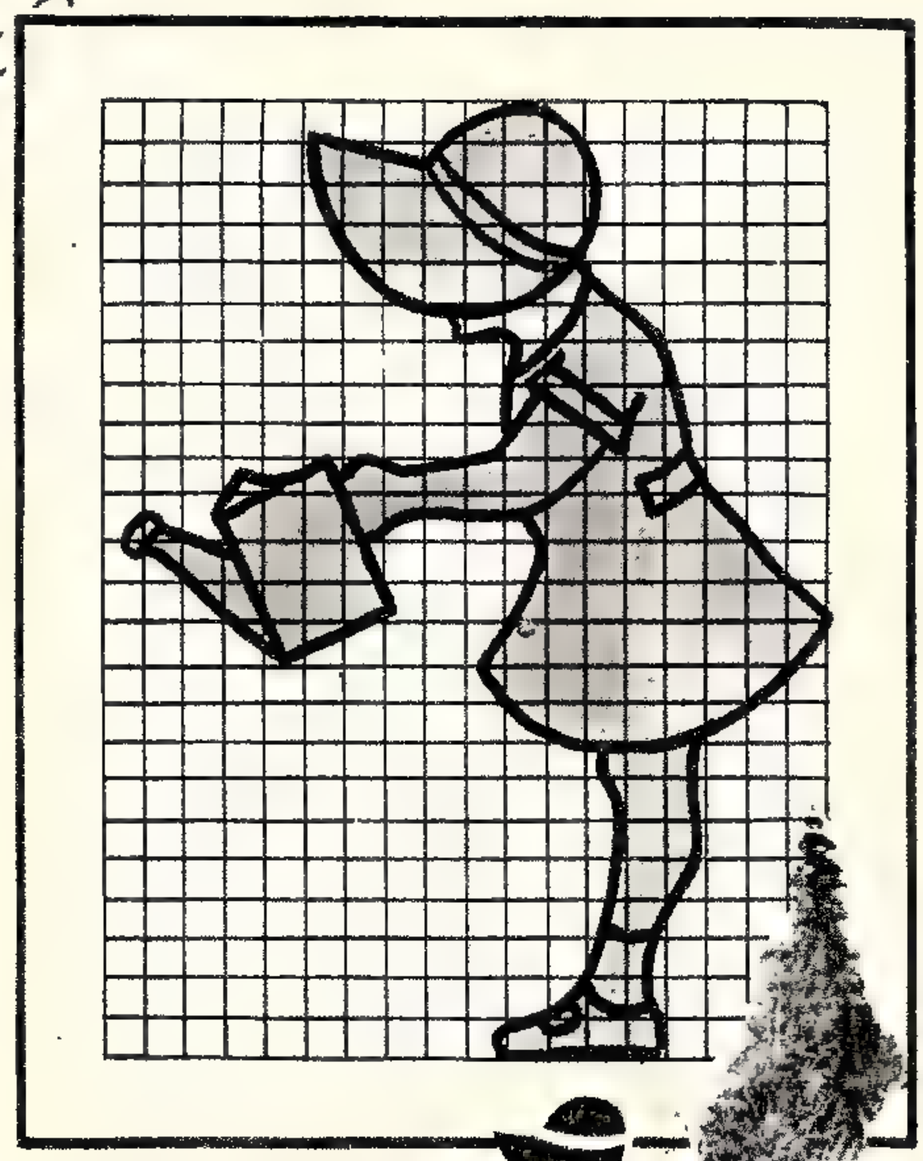
LAY OUT FULL-SIZE PATTERNS OF EACH FRAME

along the edge and mark it off into 16-inch spaces. To these, nail the frames in their relative positions, and install the sheer-battens to keep all in position. This is a temporary job, after which the battens are screwed to the frames with brass screws.

[*Continued on page* 134]

. . . SPICE YOUR . . . . . with . . . . . Distinctive Novelties

by
Dale R. Van Horn



By drawing horizontal and vertical lines across the picture to be copied, and corresponding lines a little farther apart on the wood to be cut, the problem of duplicating an outline is greatly simplified. The method makes it possible to use any desired outline for garden decoration.

EASILY made lawn novelties not only pep up a dull corner but add personality to the property itself. Cutouts in wood or metal can be made quite quickly and at little or no expense. The final result is a lawn or garden presenting an appearance obtained in no other way.

Cutting can be done with a hand coping saw, key hole saw, jig saw or band saw. After cutting out to the line, the pattern is removed and the edges sanded smooth. A priming coat of paint should follow, with particular attention paid to the end grain. Any small openings can be puttied before painting or larger ones filled with plastic wood. The second coat of paint should be of the predominating color of the character being portrayed. For instance, the little girl watering her posies has on a red dress and hat. So this second coat should be red. Then follow the trim coats with pink for the legs, face and arm. These two or three coats of paint will protect any wood novelties for two seasons against the weather. A good plan, however, is to repaint them each spring.

Supports for such novelties may be a sharpened continuation of the wood, which can be pushed into the ground, a sharpened stake fastened to the back side of the figure, or an iron rod, angle iron or strap iron fastened to the back side with screws.

The varieties of such novelties are legion. The accompanying photos do not begin to cover such possibilities. A short description of each follows.

The flower girl was cut from ¾-inch

LAWN . . .

fir plywood. This figure stands 24 inches high and a stiff strap iron, bolted to the back side of the leg, projects downward 10 inches so that the figure will be held firmly upright when placed, yet can be moved about the grounds during the summer.

This is also particularly true of the mother and baby pelicans. With deliberately enlarged pouches, these birds border the ludicrous, but enliven any corner in which they are placed. They too were cut from thick plywood with the end grain—in fact all edges—well covered with paint to prevent weathering. Iron bars fastened to the back side support them. The bars are pushed down into the ground wherever wanted.

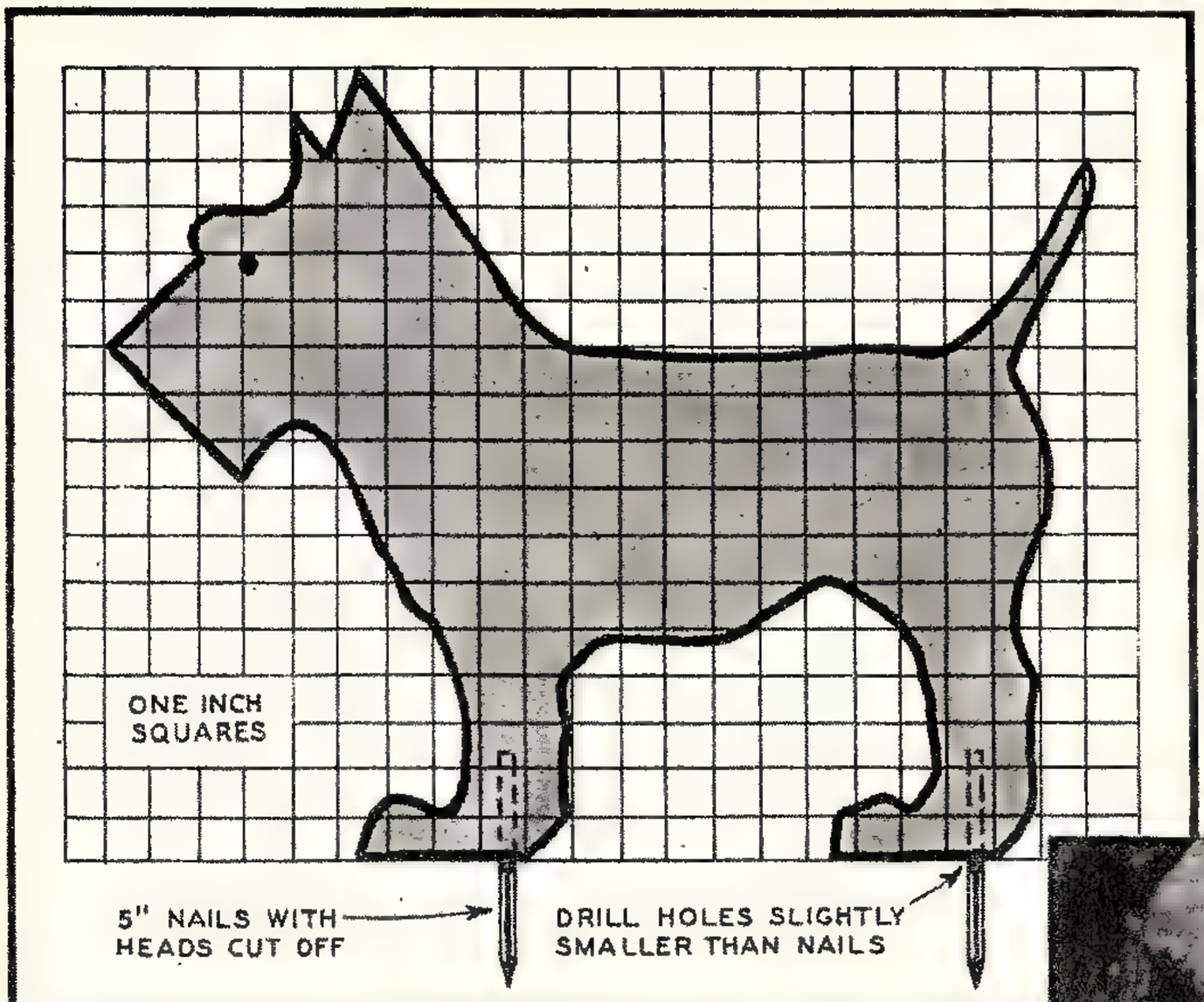
Supposed to be the last one in captivity, the doodle bug is strictly a comic. Being some-

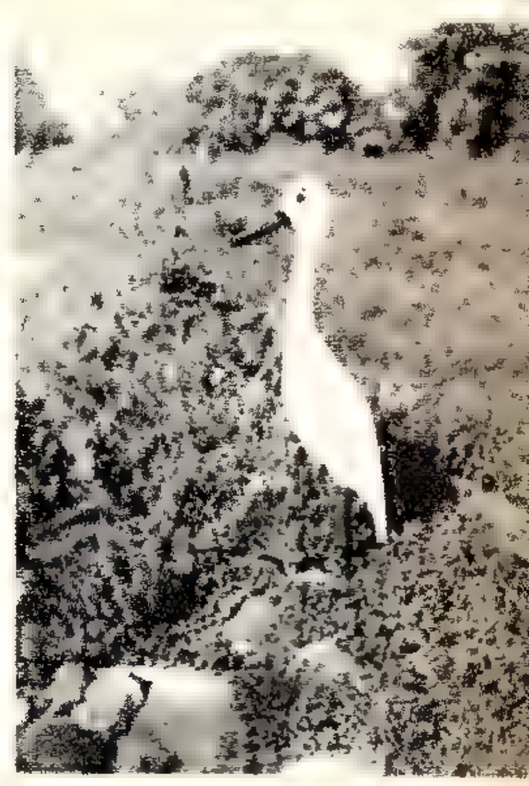
[*Continued on page* 138]

With deliberately enlarged pouches, this mother and baby pelican border the ludicrous but enliven any corner in which they are placed. One of the "three little pigs" is a popular member of the lawn cutout family and always delights the children. Bright colors add to its appearance.

Wood working fans who like to build things for their house will find enough projects in the September issue of MECHANIX ILLUSTRATED to keep them busy for the next several months. When they see the directions for making gates, fences and trellises, they will want to start dressing up the house and yard immediately. As a matter-of-fact, anyone who has a house or a yard will wonder how they ever felt satisfied without these useful decorations.

Those who enjoy having supper served outside in the yard or garden are going to find just the table and chairs they need when they see the article, "Weatherproof Garden Furniture" in the same issue.





It is easy to have a life size prototype of this cute little scottie guarding your lawn. The black color makes a good background for the house numbers. The doodle bug shown above is one of the few in captivity. The head is mounted on a short length of clock spring or a hack saw blade and each puff of wind causes it to sway in a very knowing manner. This also is popular with children as well as grown-ups.

HOW TO MAKE ELECTRO-MAGNETS

by Kenneth Murray

The iron lamp base is held securely to the table by a concealed magnet.

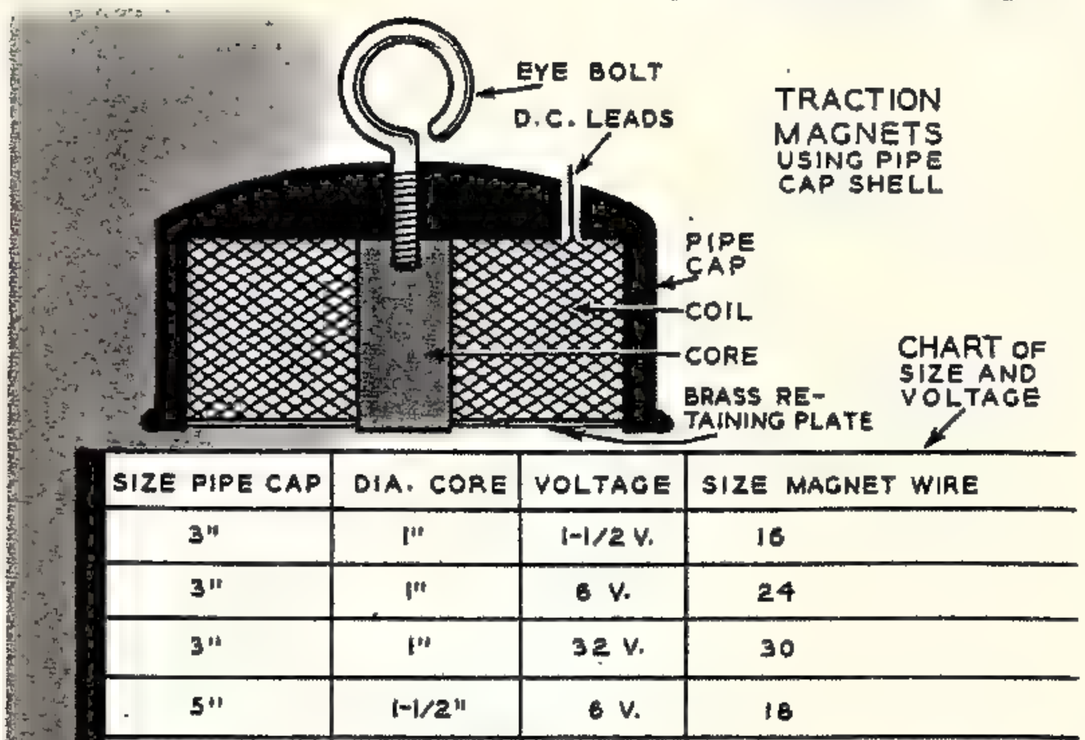
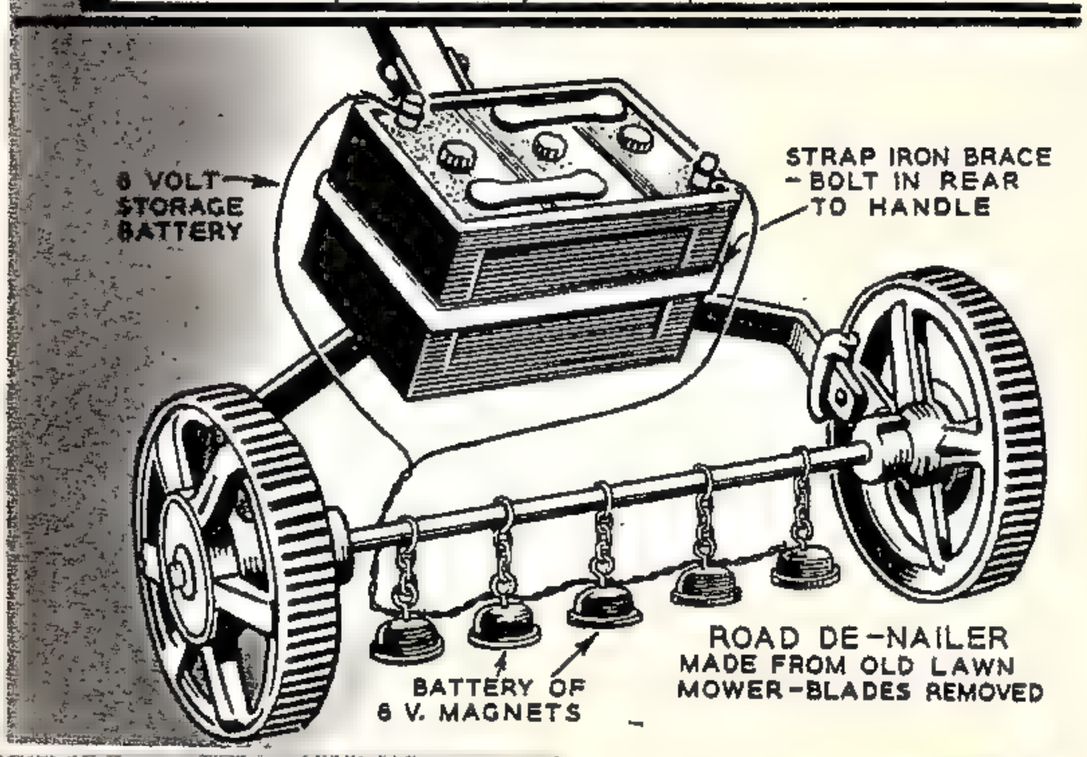
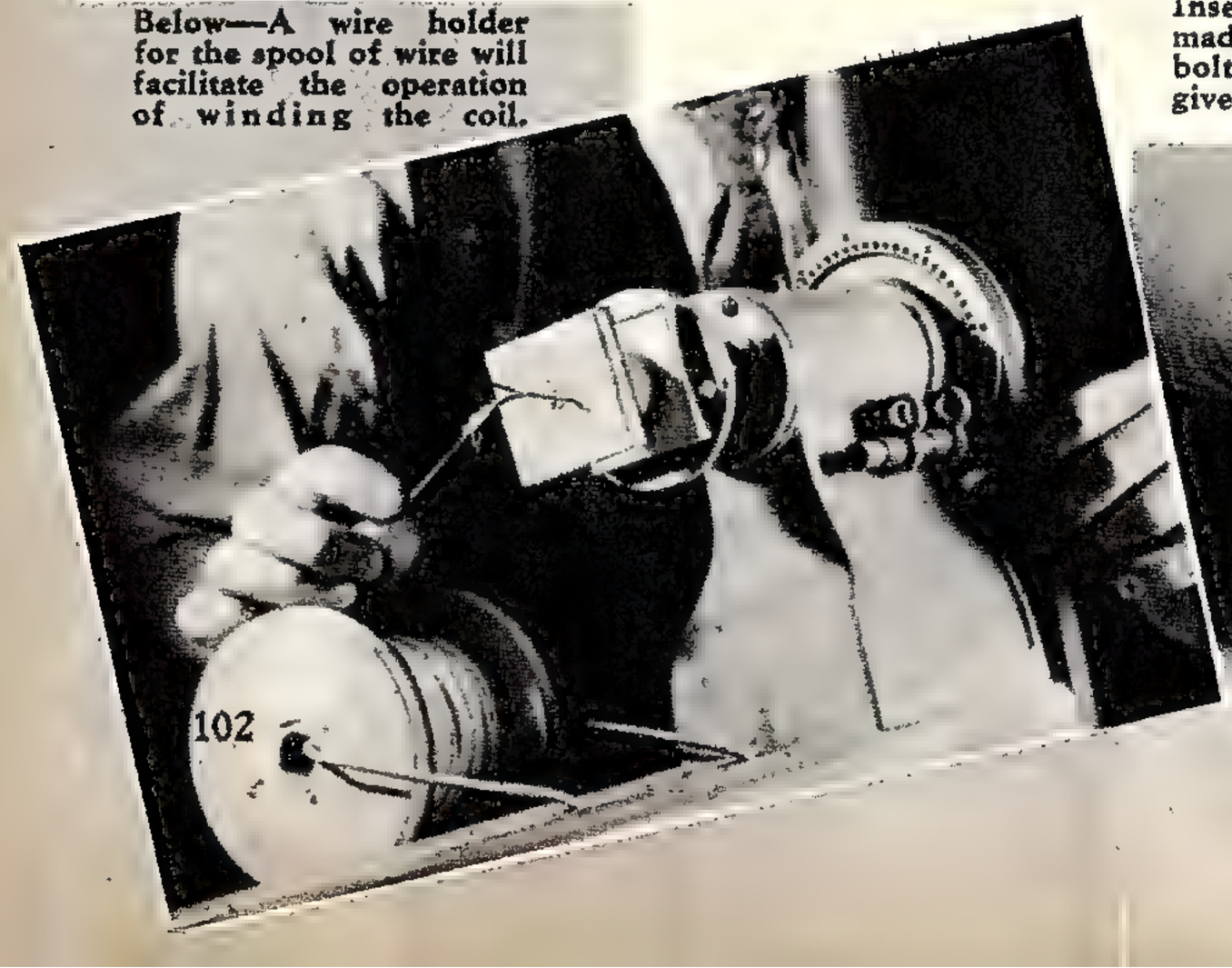


CHART OF SIZE AND VOLTAGE

SIZE PIPE CAP	DIA. CORE	VOLTAGE	SIZE MAGNET WIRE
3"	1"	1-1/2 V.	16
3"	1"	6 V.	24
3"	1"	32 V.	30
5"	1-1/2"	6 V.	18
5"	1-1/2"	32 V	26


6 VOLT STORAGE BATTERY
STRAP IRON BRACE - BOLT IN REAR TO HANDLE
BATTERY OF 6 V. MAGNETS
ROAD DE-NAILER MADE FROM OLD LAWN MOWER-BLADES REMOVED

Below—A wire holder for the spool of wire will facilitate the operation of winding the coil.



WITH arm muscles bulging like knots and putting forth his mightiest effort, the brawny leader of an Algerian tribe was unable to budge even a small metal box which rested on a crude wood platform. It was then that Robert Houdin, a French conjuror from whom our own Harry Weiss was years later to coin his stage name of Houdini, walked over to the box and easily lifted it with one finger. The act proved to the tribesman that Frenchmen were the stronger and thus Robert Houdin, on a mission for the French government, was able to quell a threatened uprising of the Algerian natives. Not that the famous magician of those times was really the stronger; under the wood platform he had concealed a powerful electromagnet which was controlled by a switch underneath his foot!

This would be very useful if you ever wished to give a demonstration of your strength, but there are many other more practical ways in which electromagnets can be utilized about the home, shop and garage. Forming the essential part of all electric motors and dynamos, without them our entire scheme of living would be set back at least a hundred years. About the workshop will be found

Inserting the cast-steel core in a heavy-duty lifting magnet made with a pipe cap. The core is held in place by the eye bolt, which also serves as a convenient handle. Above left is given construction information for various sizes of this type.

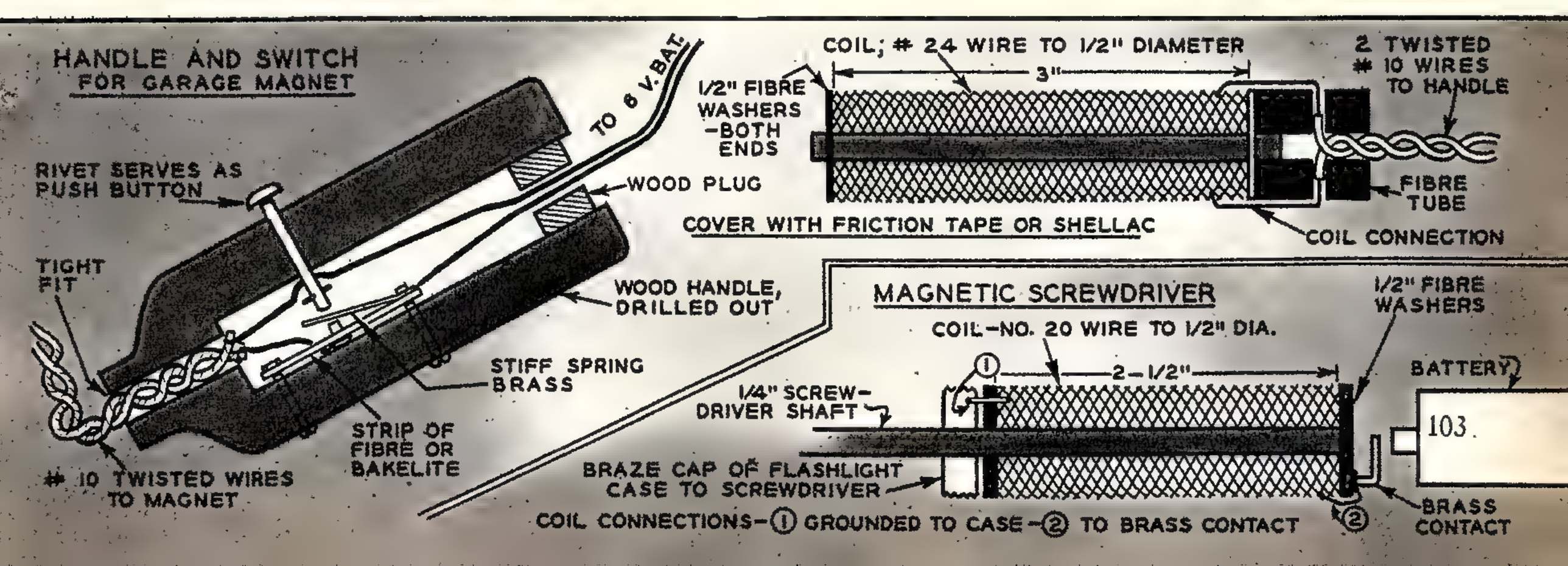
When bolts, nuts or other metal parts have to be removed from narrow or inaccessible places, this narrow garage-type magnet will be very useful.

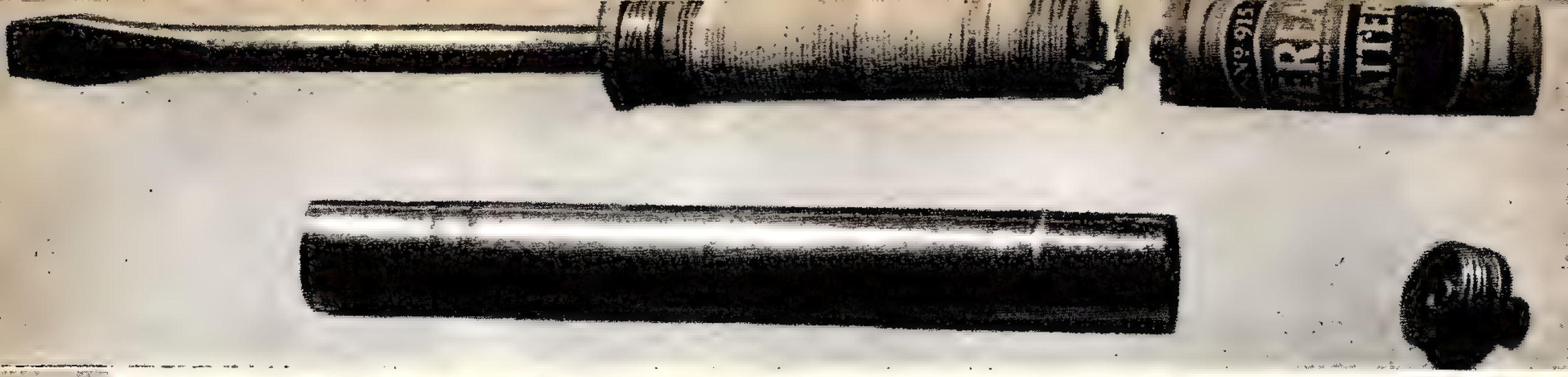
one type of magnet particularly useful:

Traction or Lifting Magnets. In even the small sizes these are capable of lifting up to several hundred pounds of iron or steel, and for carrying pounds of nails, screws and small parts from one place to another. By arranging a number of them underneath a wheeled support the tire-puncture hazzard can be eliminated. A good design consists in using a wrought-iron pipe cap for the magnet shell with an eye bolt for the handle, as shown in one of the illustrations. The core should be of either wrought iron or cast steel. Wind the coil separately, using the proper size of single cotton enamel magnet wire, in the same manner as was described in the June, 1938 issue for the winding of the welding transformer coils. When the magnet is to be used on more

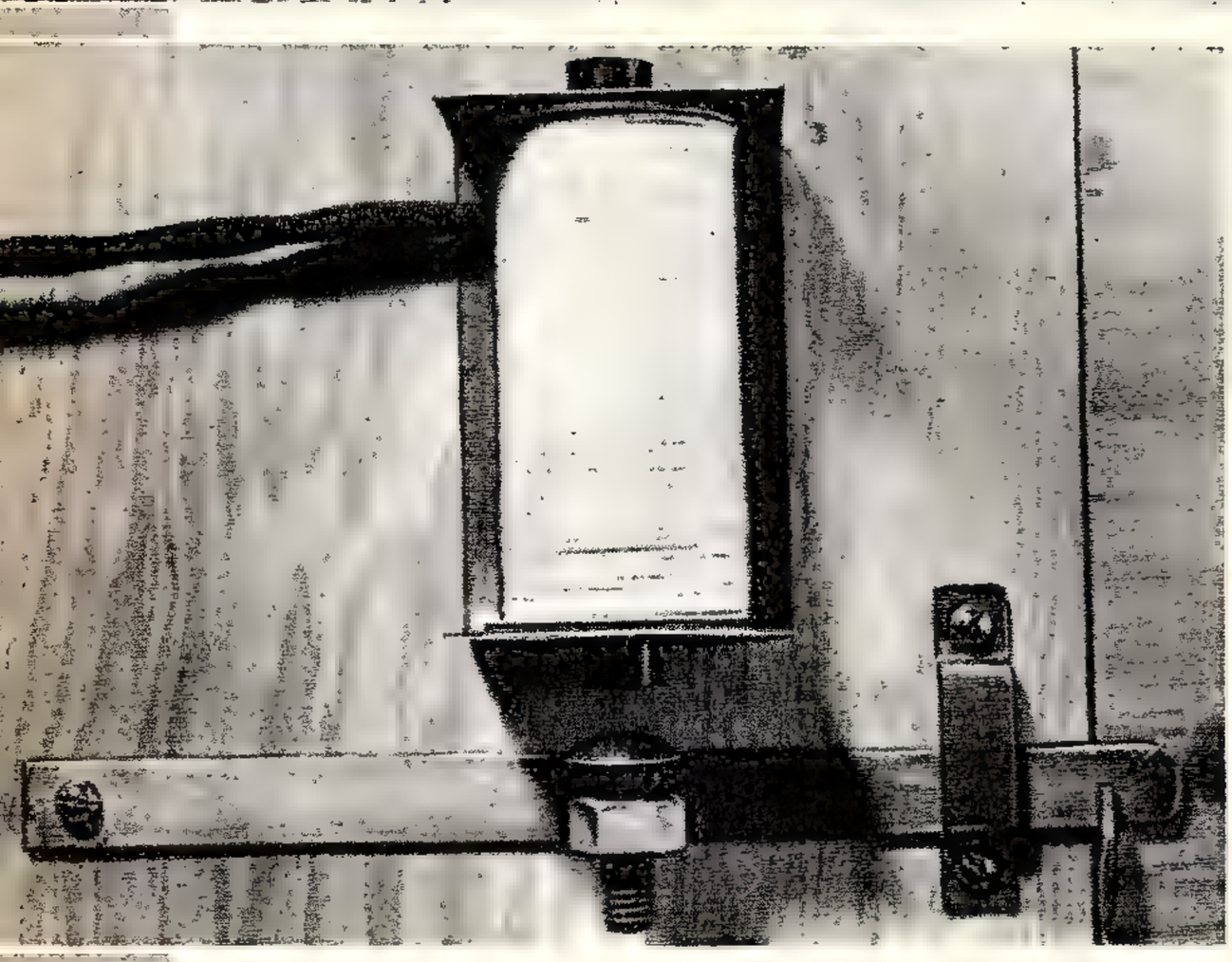
Above left—The traction or lifting magnet can hold several pounds when connected only to a single dry cell. Above —The garage type magnet showing the handle and magnet.

Below—Details for the construction of the screw driver, and garage type magnets. Right—The magnetic screw driver when completed will be capable of considerably more "pull" than the usual permanent magnet type.





A single drycell is used to power the electromagnetic screwdriver. A pen type flashlight case is used for the handle.



An electromagnet can be used to open the latch of a door when a button is pressed. It can be used for other purposes.

than 6 volts, it is good practice to cover each third layer of wire with a single thickness of shellacked paper. When winding magnet coils for direct current it is not necessary to count the number of turns; the coil in each case should be wound to fit snugly inside the space available, as determined from the measurements given in the drawings. If it is made smaller it will be become hotter in use; magnets should work at a temperature of not more than 131 deg. F. A larger coil than that called for will work at a lower temperature. In either case the "pull" or traction will be the same. A brass retaining plate will protect the coil and hold it inside the case.

Garage Magnet: With this slender, long-handled magnet you will no longer find it necessary to take down parts of a motor or transmission to retrieve a dropped bolt, nut or other part. It will also remove fine particles of metal from the crankcase. Clips are attached for hooking directly to the bar battery, and a convenient switch in the handle enables the load to be picked up or dropped instantly.

The shaft is made by twisting together two S. C. E. No. 10 or No. 8 wires; be careful not to injure the insulation while twisting, as the wires are also utilized to carry the current to the magnet. A 3¼"x¼"-wrought iron machine bolt, with head removed, makes an easily-obtainable core. Also needed are two

Left—The pancake type magnet is very powerful for its small size. Below left—A wood form is used when winding the flat coil. Below—Parts for the flat magnet before assembly.

A wood form is used to hold the laminated iron core for the alternating current magnet while it is being cut on the scroll saw. Right—Turning over the rim to make a thin unit.

½″ fiber washers and a ½″ fiber tube, to be threaded over the end of the bolt for attaching the shaft. After winding the coil neatly, protect it and the shaft with several coats of shellac, or by wrapping with friction tape and then shellacking. This magnet will lift approximately ten pounds.

Magnetic Screwdriver: If you have ever wanted a screwdriver having more traction than can be obtained by converting it into a permanent magnet, you will find this electromagnet type satisfactory. Remove the handle from a screwdriver having a ¼″ shaft, utilizing 6 inches of the latter for the coil. A new handle is provided in the form of a pen-type flashlight case, which should be brass. Braze or solder the cap that ordinarily holds and protects the lamp bulb, to the shaft of the screwdriver. When the parts are assembled this will leave room for a single cell and for making contact, which is usually formed when the battery is shifted forward by an outside device. Despite the small amount of power available, the screwdriver will have a pull of up to five pounds or more, depending on the reluctance (magnetic resistance) of the particular steel.

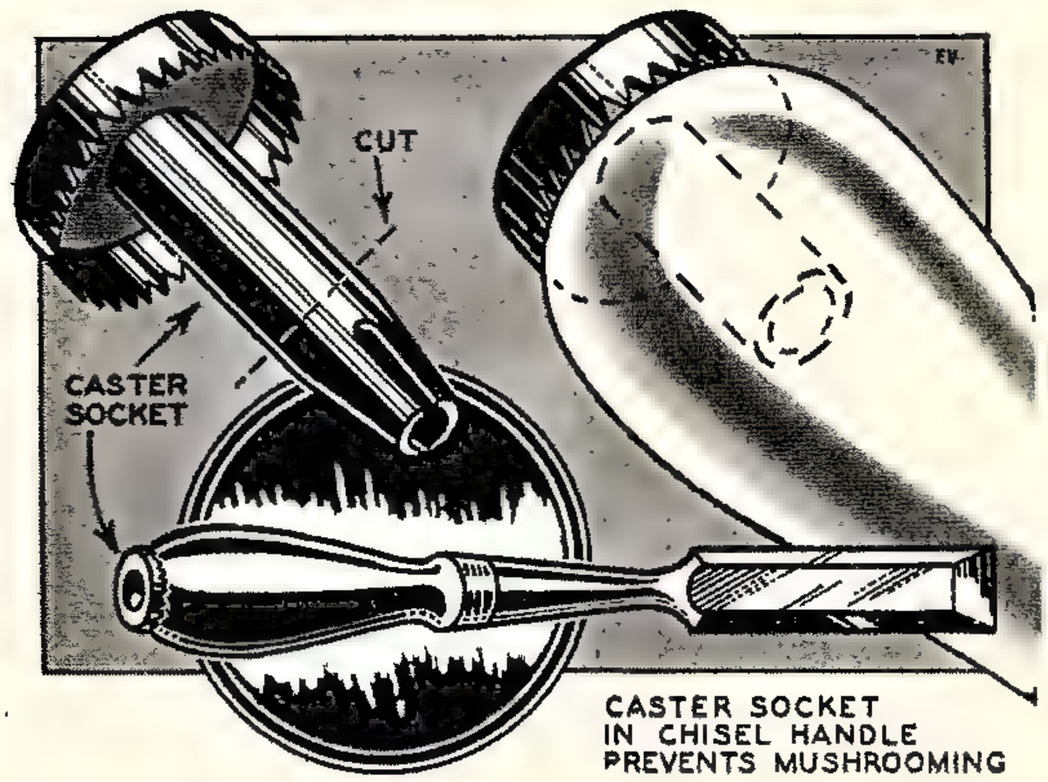
Door Latch Magnet: Ordinary door latches may easily be operated from a distance with an electromagnet by attaching a suitable armature to the latch arm, a wrought-iron bolt being used for this purpose. While one of the other magnets that have been described could be utilized, the one shown has a 3″x½″-wrought-iron core and the coil is wound to a diameter of 1½″. To operate it on 3 dry cells, wind the coil with No. 10 wire; for 6 volts use No. 14 and for 32 volts use No. 20. If the same coil is to be used non-intermittently for another purpose on 32 volts, wind with No. 22 wire.

Pancake Magnet: This magnet was designed by the author for a well-known American magician, and while it is not as efficient as some other designs, it is only ½″ thick so that it can be concealed easily. The original purpose of the magnet cannot be revealed here, but the experimenter will find it interesting for many odd applications in restricted spaces. It is very powerful at close distances and, while designed for use on several dry cells, it will operate with increased traction if used intermittently on 6 or 12 volts. No. 18 magnet wire is wound to make a coil 5″ in diameter and ½″ thick, with allowance for a 2″ diameter, ½″ thick cast-steel core. The latter is tapped and bolted to the center of a 5″ sheet-iron disc, placed on one side of the coil, with a 5″ brass disc on the face side. The rim is a strip of ¾″ wide sheet-iron which is formed into a hoop, slipped over the coil

The alternating current magnet completed and ready for use. Rivets are used to hold the laminations together.

[*Continued on page* 138]

KINKS SAVE TIME IN SHOP



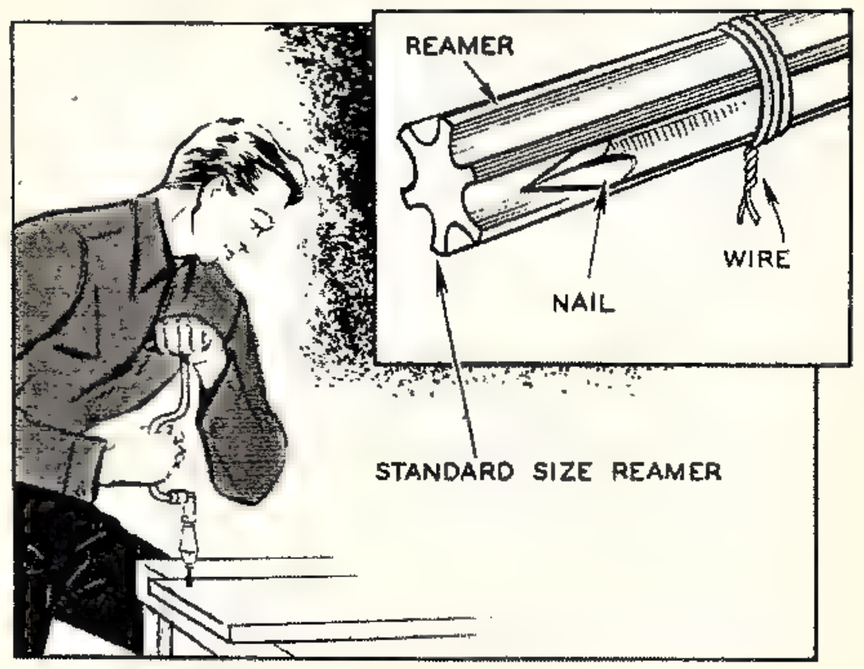
CASTER SOCKET IN CHISEL HANDLE PREVENTS MUSHROOMING

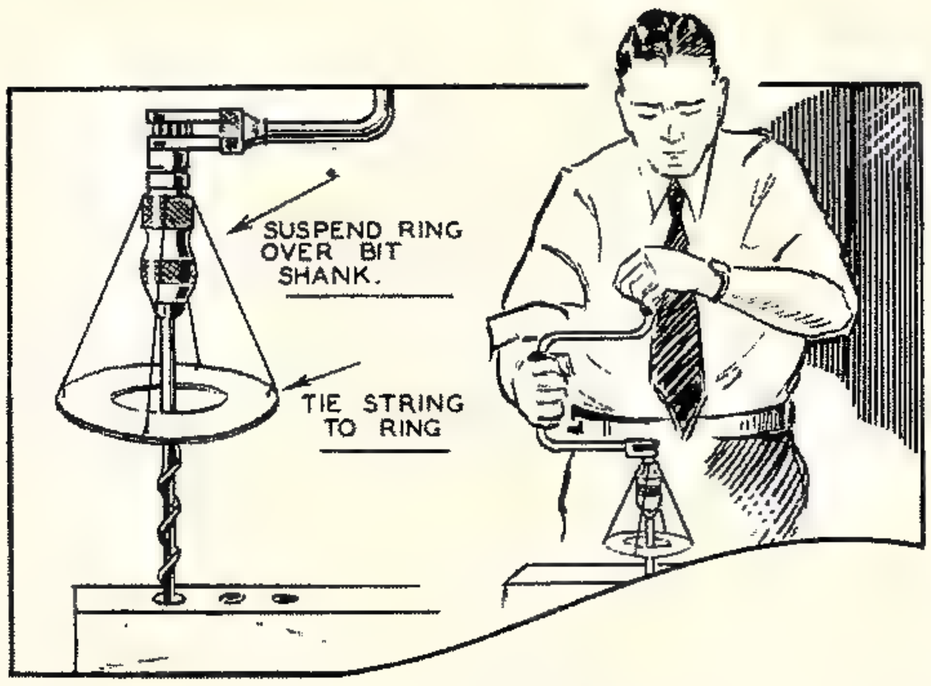
Socket Protects Tool Handle

A CASTER socket fastened to the top of a chisel as shown in the drawing at the left, will prevent battering or "mushrooming" of the wood handle. A hole of the approximate size of the caster stem should be drilled in the handle, and the socket forced in. The end of the metal barrel is cut off to reduce the length before it is fastened to the handle. This metal cap will withstand all normal hammering, completely protecting the wood. A wooden mallet always should be used with chisels; never a metal hammer.—W. C. Leckey.

Wire Nail Increases Reamer Size

WHEN it is necessary to ream out a hole to a slight oversize and no expansion reamer is available, a quickly improvised substitute can be made as shown at the right. A wire finishing nail is fitted into one of the chip slots of the reamer. The nail then should be filed down so that it extends above the reamer cutting edge the desired distance. The pointed end of the nail should be tapered so that it enters the hole easily. Hand-drawn wire can be used instead of a nail.—K. F. Keith.



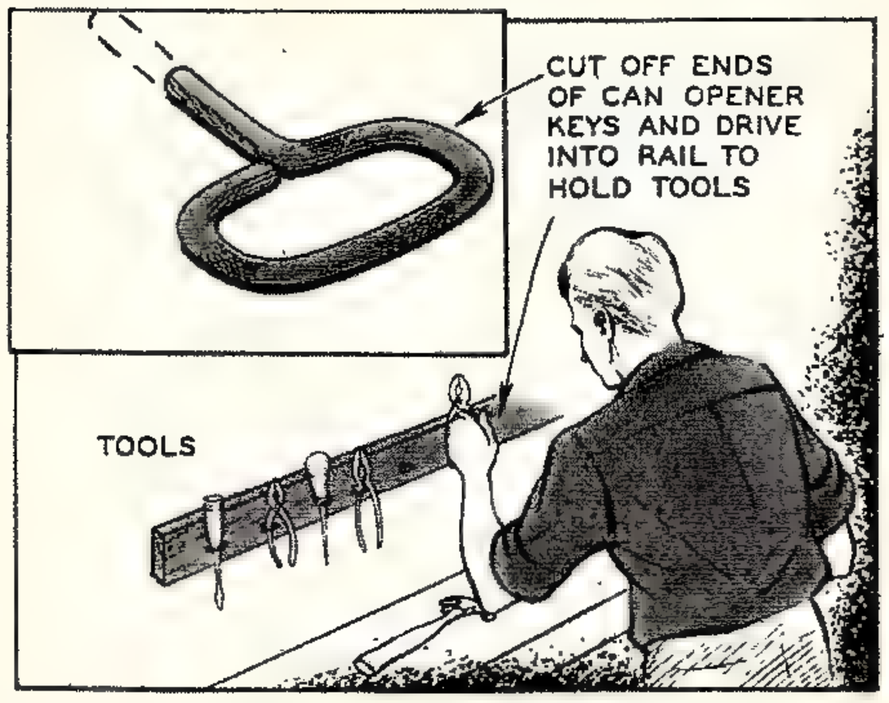


Metal Ring Aids Vertical Boring

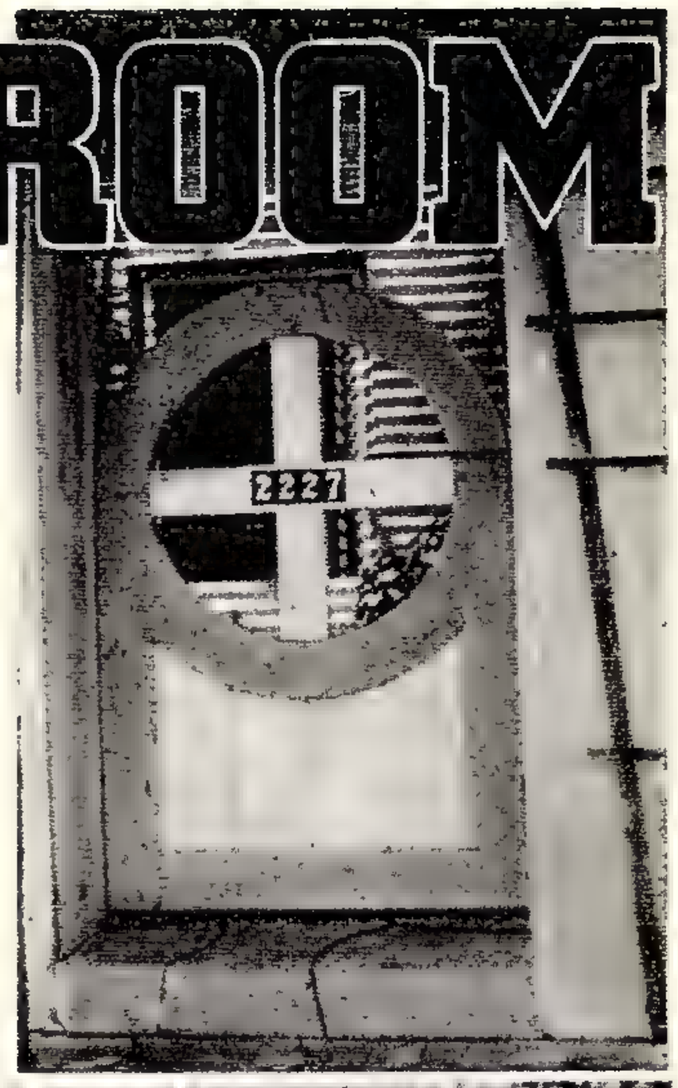
WHEN boring vertical holes the problem of keeping the bit perpendicular to the wood becomes difficult at times. When a series of holes are necessary, the problem becomes serious. However, it can be overcome by suspending a metal ring around the bit shank as shown in the drawing at left. Any position off the vertical becomes apparent immediately as the ring swings free over the hole center. It is a simple device to make and can be removed when not needed.—O. E. Olson.

Can Opener Keys Hold Tools

OLD can opener keys can be put to good use in the shop by using them to hold small tools in convenient positions at the rear of the bench. The holes to be drilled in the batten should be slightly smaller in diameter than the keys, so that they can be driven in place. The slotted portion of the key can be cut off if the batten is not thick enough to take the entire length. The distance they are set apart will be determined largely by the shape and size of the tools they are to support.



ADD A SUN ROOM

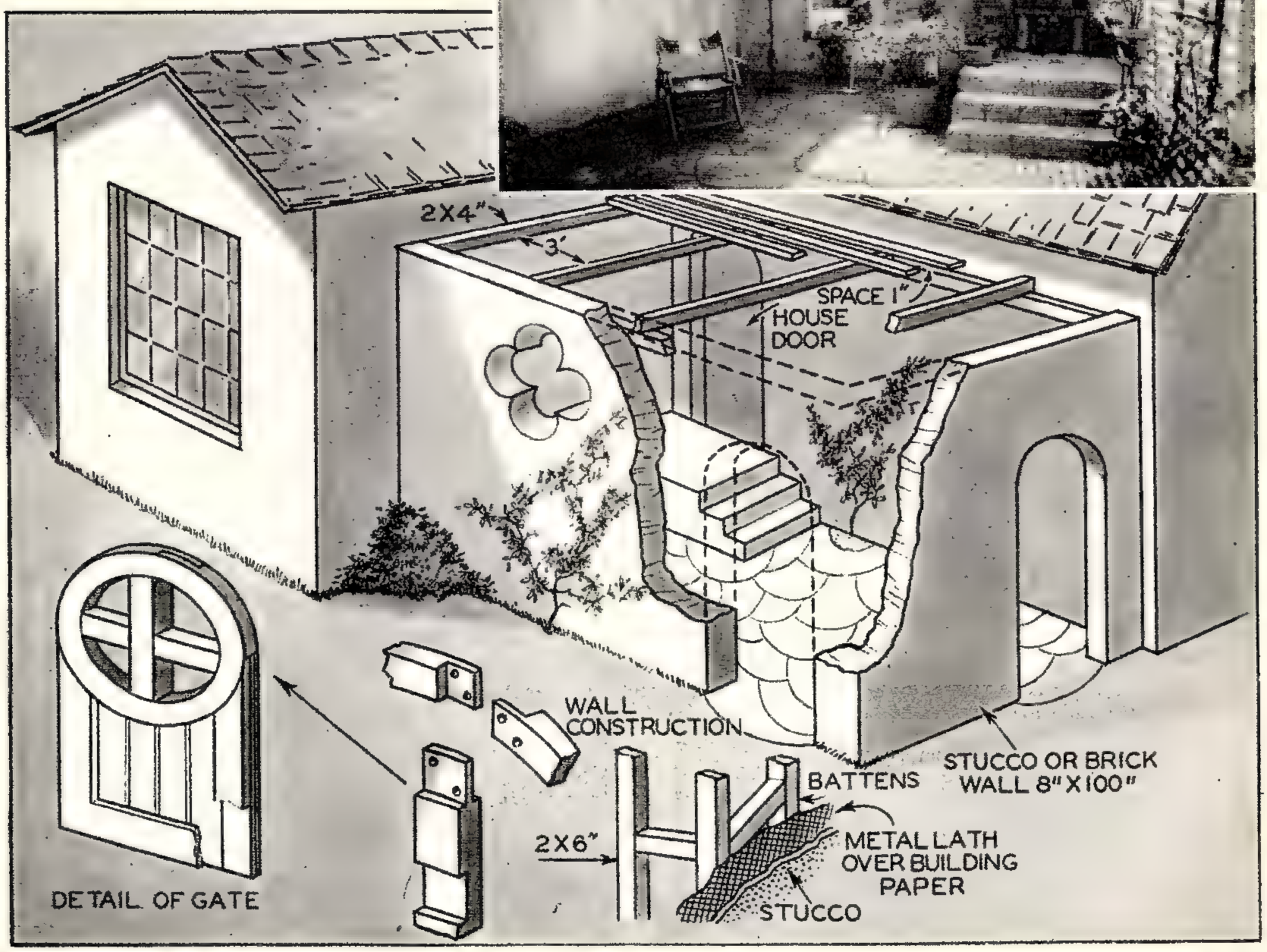


WHERE a wing of the house extends at right angles to the main structure, with a door near the corner, a large and very inviting sun room can be constructed by adding two walls and a trellis over the top. A flagstone or concrete floor completes the job. Borders or pockets can be left along the walls into which can be set clinging vines or shrubs.

A stucco wall is inexpensive and relatively easy to build. Set up two-by-four studs on an eight-by-eight concrete footing extending about one inch above the ground level. Brace these with intermediate diagonals. Then cover both sides of the structure with building-paper reinforced with baling wire between it and the studding. Nail lath or battens to studding over the paper and then metal lath, with stucco over this.

Two-by-fours support battens spaced 1 inch apart on the roof. If heavy vines are to be trained over the top, use two-by-six joists. This type of covering, offering partial shade, will make it possible to grow ferns and similar delicate plants. Hanging baskets will add to the charm of the room.

An interesting gate suitable for an arched doorway is shown in detail. This can easily be constructed with the help of a scroll or bandsaw. When finishing the concrete floor, it should be sloped slightly to permit rain water to run off.



Build This XP-3 Gas-Powered Model

The photo above clearly shows the completed, but unassembled, fuselage, center section, wing sections, tail booms and tail unit.

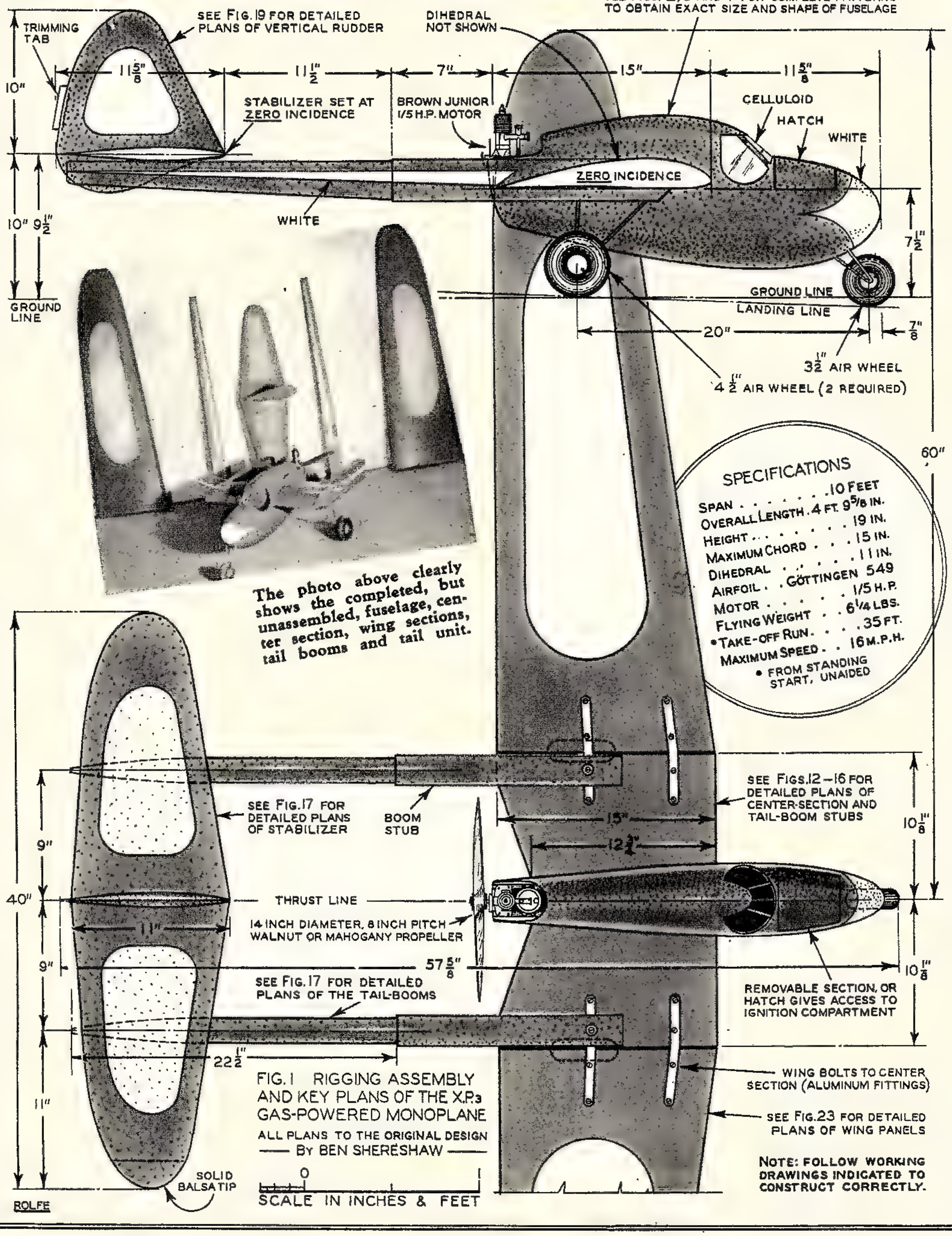

SEE FIG. 19 FOR DETAILED PLANS OF VERTICAL RUDDER
TRIMMING TAB
DIHEDRAL NOT SHOWN
SEE FIGS. 2; 3 AND 4 FOR COMPLETE PATTERNS TO OBTAIN EXACT SIZE AND SHAPE OF FUSELAGE
10"
11 5/8"
11 1/2"
7"
15"
11 5/8"
STABILIZER SET AT ZERO INCIDENCE
BROWN JUNIOR 1/5 H.P. MOTOR
CELLULOID HATCH
WHITE
ZERO INCIDENCE
WHITE
10" 9 1/2"
7 1/2"
GROUND LINE
LANDING LINE
20"
7/8"
3 1/2" AIR WHEEL
4 1/2" AIR WHEEL (2 REQUIRED)
60"
SPECIFICATIONS
SPAN . . . . . 10 FEET
OVERALL LENGTH . 4 FT. 9 5/8 IN.
HEIGHT . . . . . 19 IN.
MAXIMUM CHORD . . . 15 IN.
DIHEDRAL . . . . . 11 IN.
AIRFOIL . . GÖTTINGEN 549
MOTOR . . . . . 1/5 H.P.
FLYING WEIGHT . . 6 1/4 LBS.
*TAKE-OFF RUN . . . . 35 FT.
MAXIMUM SPEED . . 16 M.P.H.
* FROM STANDING START, UNAIDED
SEE FIG. 17 FOR DETAILED PLANS OF STABILIZER
BOOM STUB
SEE FIGS. 12–16 FOR DETAILED PLANS OF CENTER-SECTION AND TAIL-BOOM STUBS
9"
40"
THRUST LINE
14 INCH DIAMETER, 8 INCH PITCH WALNUT OR MAHOGANY PROPELLER
11"
9"
57 5/8"
10 1/8"
SEE FIG. 17 FOR DETAILED PLANS OF THE TAIL-BOOMS
22 1/2"
REMOVABLE SECTION, OR HATCH GIVES ACCESS TO IGNITION COMPARTMENT
WING BOLTS TO CENTER SECTION (ALUMINUM FITTINGS)
SEE FIG. 23 FOR DETAILED PLANS OF WING PANELS
NOTE: FOLLOW WORKING DRAWINGS INDICATED TO CONSTRUCT CORRECTLY.
11"
SOLID BALSA TIP
ROLFE
0
SCALE IN INCHES & FEET

FIG. 1 RIGGING ASSEMBLY AND KEY PLANS OF THE X.P.3 GAS-POWERED MONOPLANE

ALL PLANS TO THE ORIGINAL DESIGN — BY BEN SHERESHAW —

"PUSHER" Airplane

Circle—Any miniature gasoline engine of 1/5 horsepower, such as this one, can be used to power the XP-3. Above—The model shows its graceful lines in this simulated flight position.

PART I

by

Ben Shereshaw

THE building and flying of the XP-3 (experimental pusher) provides the gas modeler with a design incorporating structural and aerodynamic characteristics far different from those found in conventional gas models. In the development of the design many problems were encountered, necessitating the construction of three complete models—the XP-1, XP-2 and XP-3—before the "bugs" were eliminated.

The difficulties of the design were thoroughly ironed out with the construction of the XP-3, the take-off run being noticeably decreased, while the trim of the model remains almost constant after the engine has stopped. The construction details follow.

First plot out the eleven bulkheads in full size from the squared half-sections given in Fig. 4. Each pattern should be accurately drawn on stiff paper or cardboard and all notches such as for keel, motor bearers, etc., properly laid out and cut. Details of the required notches are shown in Fig. 4, and in other sketches. All bulkheads except No. 3 are of two-ply balsa. No. 3 bulkhead is a combination of 3-ply and 1-ply as will be seen from the construction sketches. The plywood is formed by laying opposing grains of $\frac{3}{32}$-inch sheet balsa in a good grade glue. The sheets should be pressed firmly together and left to dry for at least twelve hours.

Additional sections of the forward bulkheads will be required for the removable hatch so when laying out the patterns on the finished plywood sheets do not forget to include these pieces. The patterns should be lightly cemented to the surface of the plywood and the individual bulkheads cut out

FIG. 5 TYPICAL BULKHEAD DETAILS

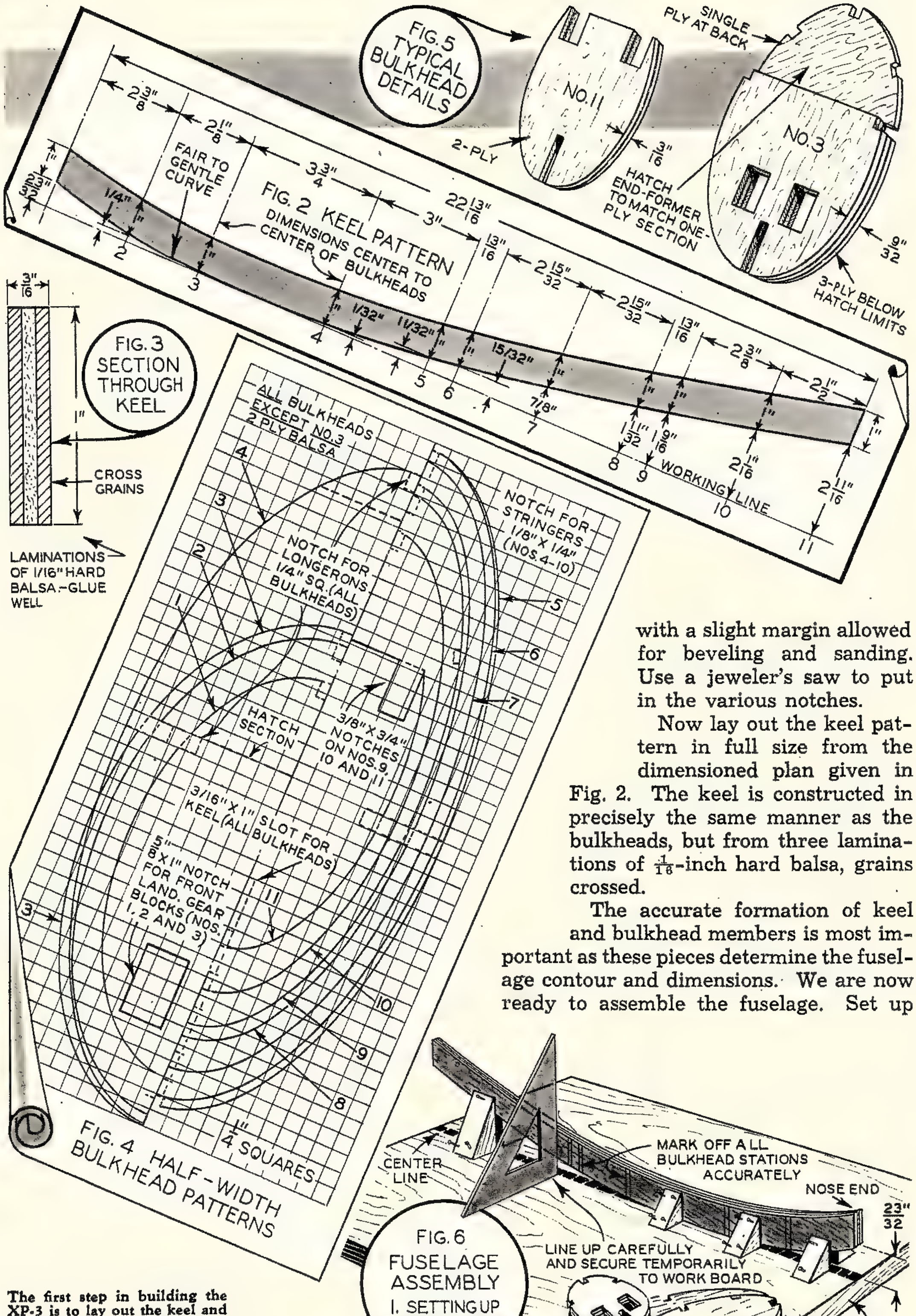


FIG. 2 KEEL PATTERN

FIG. 3 SECTION THROUGH KEEL

FIG. 4 HALF-WIDTH BULKHEAD PATTERNS

with a slight margin allowed for beveling and sanding. Use a jeweler's saw to put in the various notches.

Now lay out the keel pattern in full size from the dimensioned plan given in Fig. 2. The keel is constructed in precisely the same manner as the bulkheads, but from three laminations of $\frac{1}{16}$-inch hard balsa, grains crossed.

The accurate formation of keel and bulkhead members is most important as these pieces determine the fuselage contour and dimensions. We are now ready to assemble the fuselage. Set up

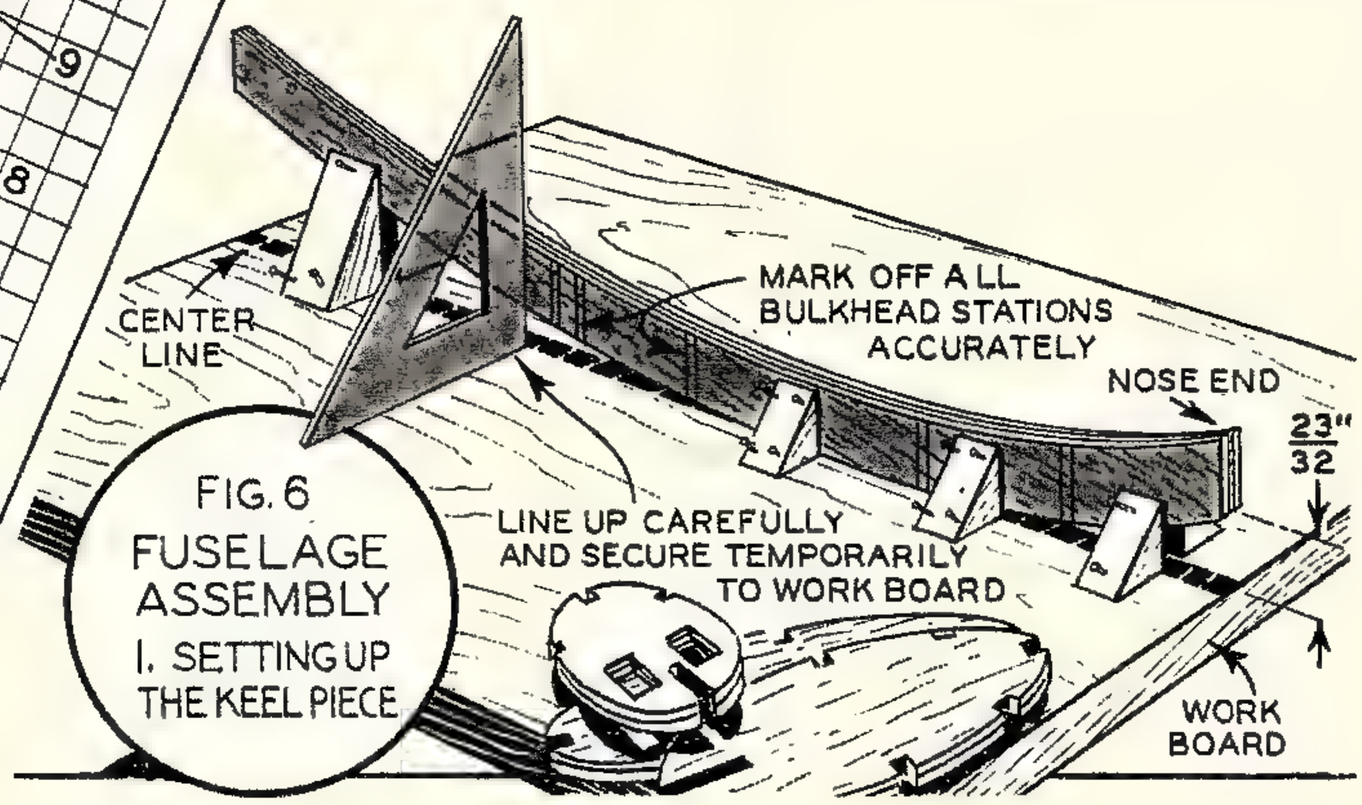
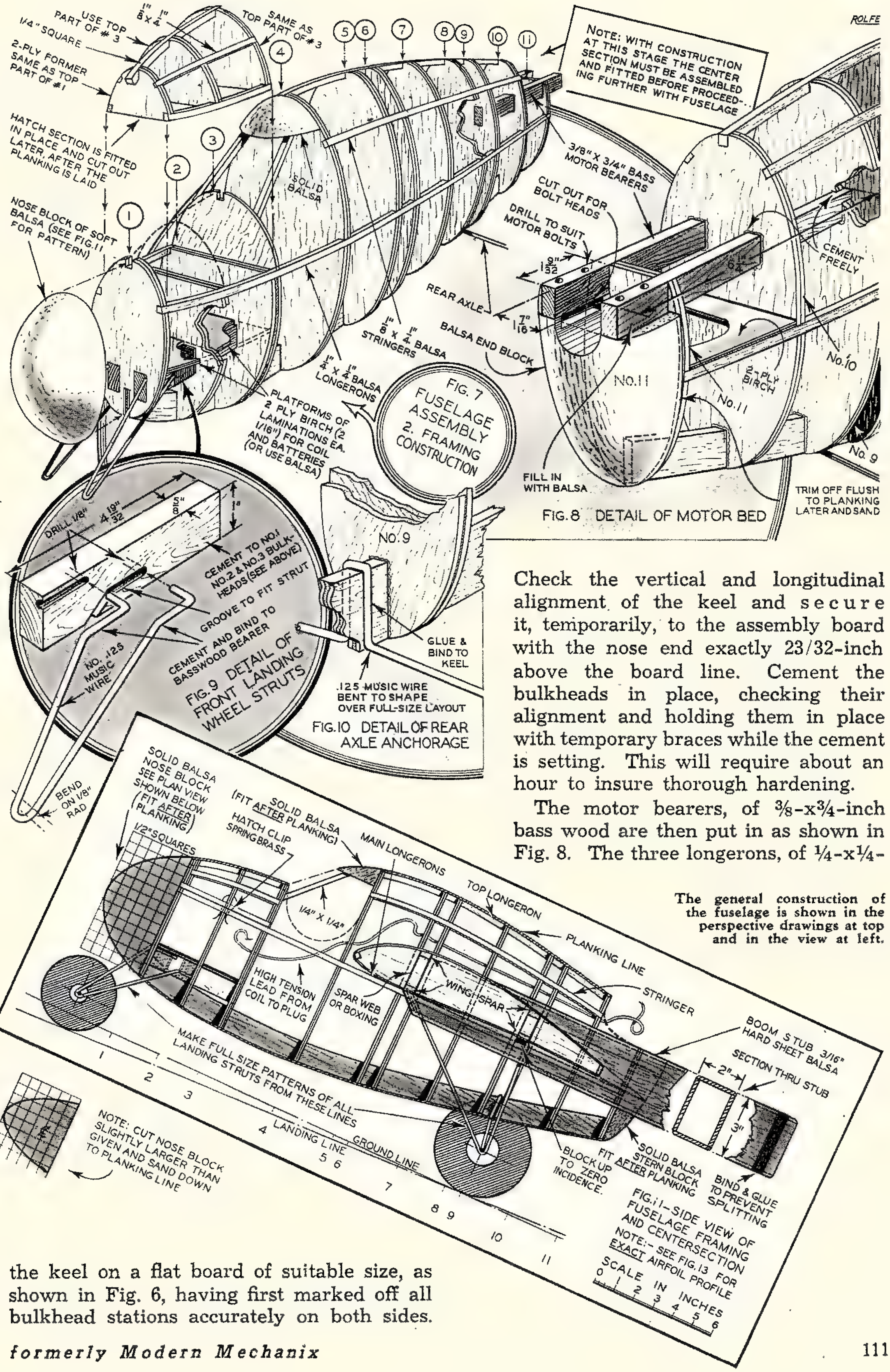


FIG. 6 FUSELAGE ASSEMBLY 1. SETTING UP THE KEEL PIECE

The first step in building the XP-3 is to lay out the keel and bulkheads. The sketches and patterns above show how these important parts are plotted, cut to shape and assembled.


ROLFE
NOTE: WITH CONSTRUCTION AT THIS STAGE THE CENTER SECTION MUST BE ASSEMBLED AND FITTED BEFORE PROCEEDING FURTHER WITH FUSELAGE
USE TOP PART OF #3
1/4" SQUARE
2-PLY FORMER SAME AS TOP PART OF #1
HATCH SECTION IS FITTED IN PLACE AND CUT OUT LATER, AFTER THE PLANKING IS LAID
NOSE BLOCK OF SOFT BALSA (SEE FIG.11 FOR PATTERN)
SAME AS TOP PART OF #3
SOLID BALSA
3/8" X 3/4" BASS MOTOR BEARERS
CUT OUT FOR BOLT HEADS
DRILL TO SUIT MOTOR BOLTS
CEMENT FREELY
REAR AXLE
BALSA END BLOCK
1/8" X 1/4" BALSA STRINGERS
1/4" X 1/4" BALSA LONGERONS
PLATFORMS OF 2 PLY BIRCH (2 LAMINATIONS EA. 1/16") FOR COIL AND BATTERIES (OR USE BALSA)
No.10
No.11
2 PLY BIRCH
No.9
FILL IN WITH BALSA
TRIM OFF FLUSH TO PLANKING LATER AND SAND
FIG. 7 FUSELAGE ASSEMBLY 2. FRAMING CONSTRUCTION
FIG. 8 DETAIL OF MOTOR BED
DRILL 1/8"
CEMENT TO NO.1 NO.2 & NO.3 BULKHEADS (SEE ABOVE)
GROOVE TO FIT STRUT
CEMENT AND BIND TO BASSWOOD BEARER
NO. .125 MUSIC WIRE
BEND ON 1/8" RAD
GLUE & BIND TO KEEL
.125 MUSIC WIRE BENT TO SHAPE OVER FULL-SIZE LAYOUT
FIG. 9 DETAIL OF FRONT LANDING WHEEL STRUTS
FIG. 10 DETAIL OF REAR AXLE ANCHORAGE
SOLID BALSA NOSE BLOCK SEE PLAN VIEW SHOWN BELOW (FIT AFTER PLANKING)
SOLID BALSA (FIT AFTER PLANKING)
HATCH CLIP SPRING BRASS
1/2" SQUARES
MAIN LONGERONS
TOP LONGERON
PLANKING LINE
STRINGER
1/4" X 1/4"
HIGH TENSION LEAD FROM COIL TO PLUG
SPAR WEB OR BOXING
WING SPAR
BOOM STUB 3/16" HARD SHEET BALSA
SECTION THRU STUB
2"
3"
MAKE FULL SIZE PATTERNS OF ALL LANDING STRUTS FROM THESE LINES
LANDING LINE
GROUND LINE
BLOCK UP TO ZERO INCIDENCE.
SOLID BALSA STERN BLOCK FIT AFTER PLANKING
BIND & GLUE TO PREVENT SPLITTING
NOTE: CUT NOSE BLOCK SLIGHTLY LARGER THAN GIVEN AND SAND DOWN TO PLANKING LINE
FIG. 11 - SIDE VIEW OF FUSELAGE FRAMING AND CENTERSECTION
NOTE:- SEE FIG. 13 FOR EXACT AIRFOIL PROFILE
SCALE IN INCHES

Check the vertical and longitudinal alignment of the keel and secure it, temporarily, to the assembly board with the nose end exactly 23/32-inch above the board line. Cement the bulkheads in place, checking their alignment and holding them in place with temporary braces while the cement is setting. This will require about an hour to insure thorough hardening.

The motor bearers, of 3/8-x3/4-inch bass wood are then put in as shown in Fig. 8. The three longerons, of 1/4-x1/4-

The general construction of the fuselage is shown in the perspective drawings at top and in the view at left.

the keel on a flat board of suitable size, as shown in Fig. 6, having first marked off all bulkhead stations accurately on both sides.

inch straight-grained balsa selected for uniform bending qualities, are next put in and the stringers of ⅛-x¼-inch material likewise inserted and cemented down. During this entire operation it is important to keep a careful check on the alignment of the whole assembly.

Where the hatch occurs addi-

[*Continued on page* 136]

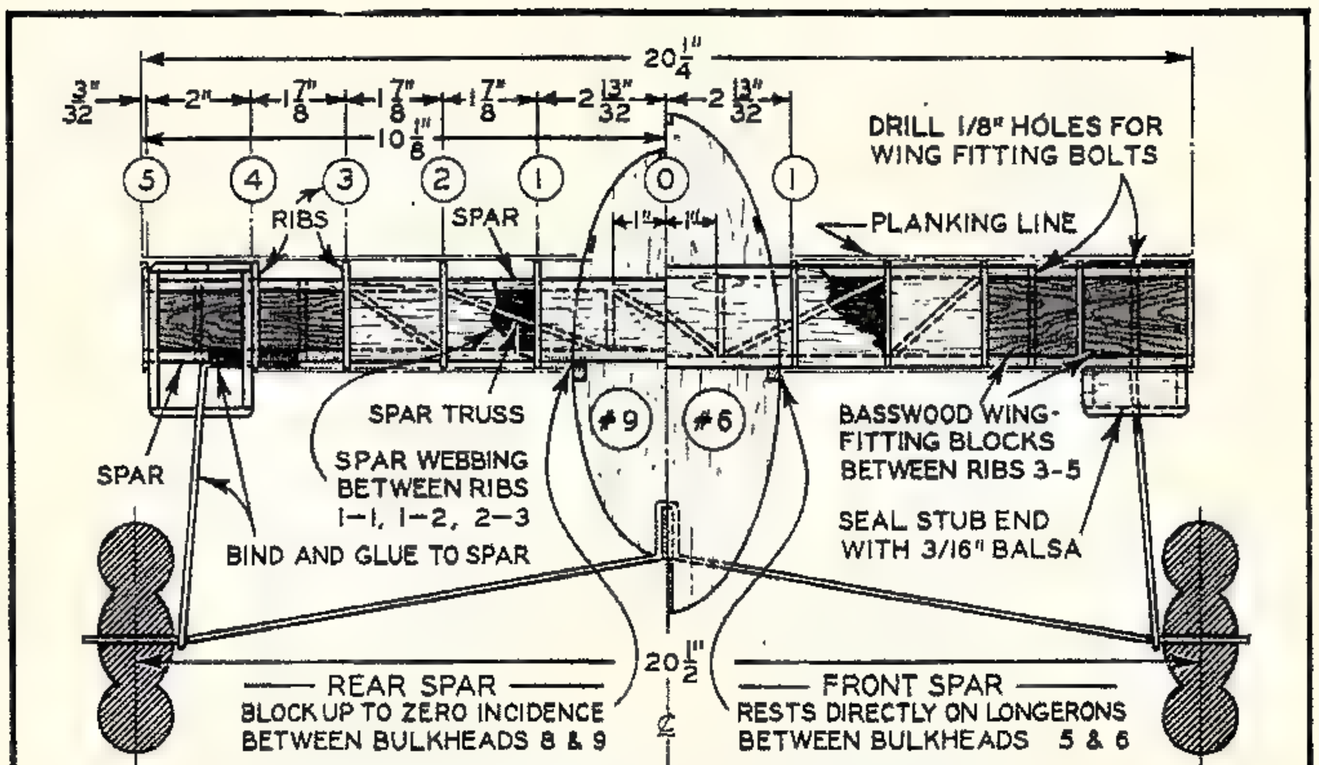


FIG. 12 FRONT ELEVATION OF CENTERSECTION (LOOKING AFT), SCALE AS IN FIG. 11

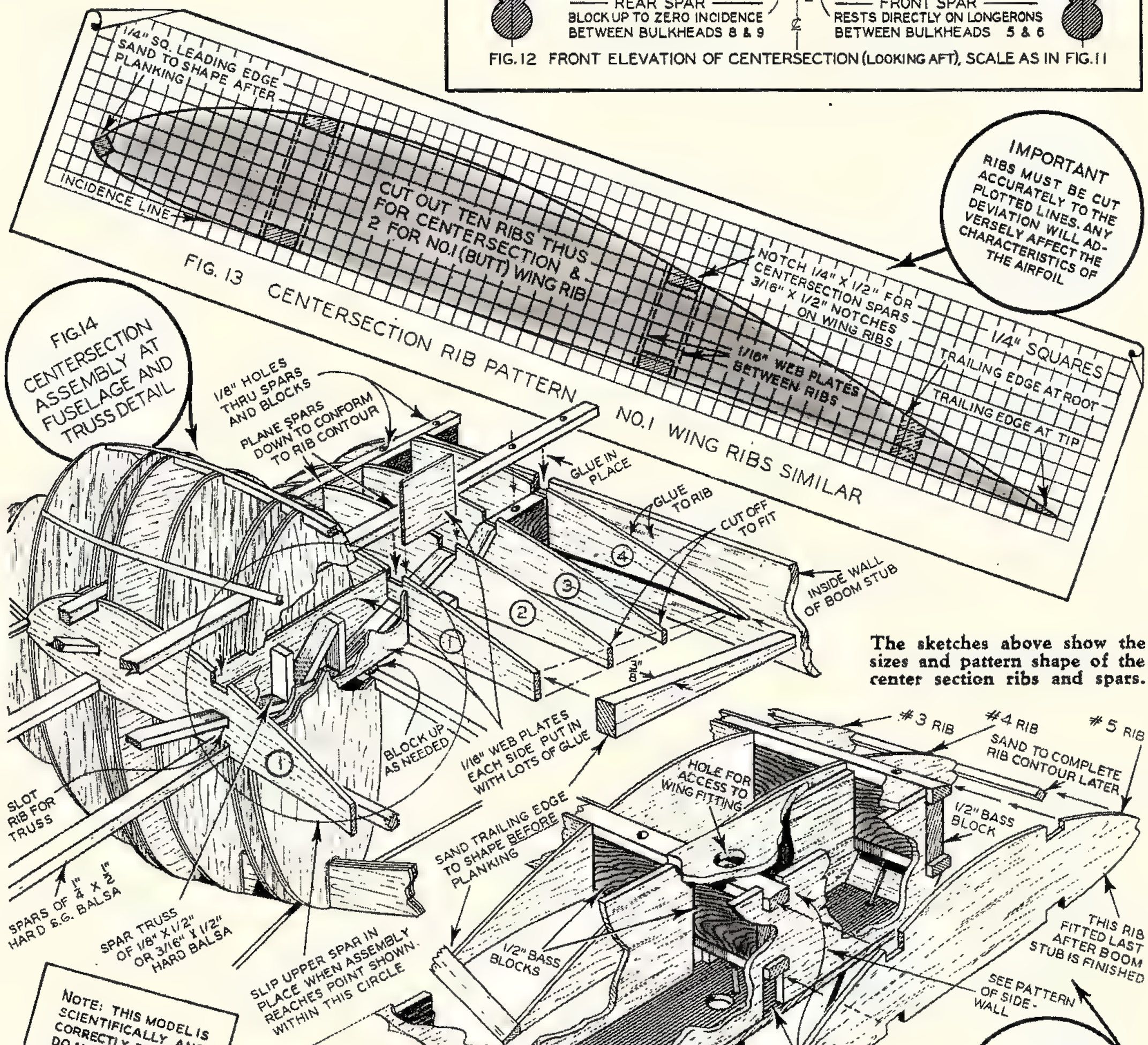

1/4" SQ. LEADING EDGE SAND TO SHAPE AFTER PLANKING
INCIDENCE LINE
CUT OUT TEN RIBS THUS — FOR CENTERSECTION & 2 FOR NO.1 (BUTT) WING RIB
NOTCH 1/4" X 1/2" FOR CENTERSECTION SPARS
3/16" X 1/2" NOTCHES ON WING RIBS
1/16" WEB PLATES BETWEEN RIBS
1/4" SQUARES
TRAILING EDGE AT ROOT
TRAILING EDGE AT TIP
IMPORTANT
RIBS MUST BE CUT ACCURATELY TO THE PLOTTED LINES. ANY DEVIATION WILL ADVERSELY AFFECT THE CHARACTERISTICS OF THE AIRFOIL

FIG. 13 CENTERSECTION RIB PATTERN NO.1 WING RIBS SIMILAR

FIG. 14
CENTERSECTION ASSEMBLY AT FUSELAGE AND TRUSS DETAIL
1/8" HOLES THRU SPARS AND BLOCKS
PLANE SPARS DOWN TO CONFORM TO RIB CONTOUR
GLUE IN PLACE
GLUE TO RIB
CUT OFF TO FIT
INSIDE WALL OF BOOM STUB
8 3/4"
BLOCK UP AS NEEDED
1/16" WEB PLATES EACH SIDE PUT IN WITH LOTS OF GLUE
SLOT RIB FOR TRUSS
SPARS OF 1/4" X 1/2" HARD S.G. BALSA
SPAR TRUSS OF 1/8" X 1/2" OR 3/16" X 1/2" HARD BALSA
SLIP UPPER SPAR IN PLACE WHEN ASSEMBLY REACHES POINT SHOWN WITHIN THIS CIRCLE
#3 RIB
#4 RIB
#5 RIB
SAND TO COMPLETE RIB CONTOUR LATER
HOLE FOR ACCESS TO WING FITTING
1/2" BASS BLOCK
SAND TRAILING EDGE TO SHAPE BEFORE PLANKING
1/2" BASS BLOCKS
THIS RIB FITTED LAST AFTER BOOM STUB IS FINISHED
SEE PATTERN OF SIDE-WALL
FILL IN WITH SMALL PIECES OF 3/16" BALSA
SAND EDGES 1/4-ROUND AND COVER WITH SILK
BIND WITH TINNED WIRE AND SOLDER
BIND

The sketches above show the sizes and pattern shape of the center section ribs and spars.

NOTE: THIS MODEL IS SCIENTIFICALLY AND CORRECTLY DESIGNED. DO NOT ATTEMPT ANY CHANGES IN THE BASIC DESIGN. DIMENSIONS AS GIVEN TAKE PRECEDENCE OVER LINES IF MINOR DIVERGENCES OCCUR IN THE PLANS

ROLFE

FIG. 15 CENTERSECTION ASSEMBLY AT SPAR TIPS WITH BOOM STUB DETAILS

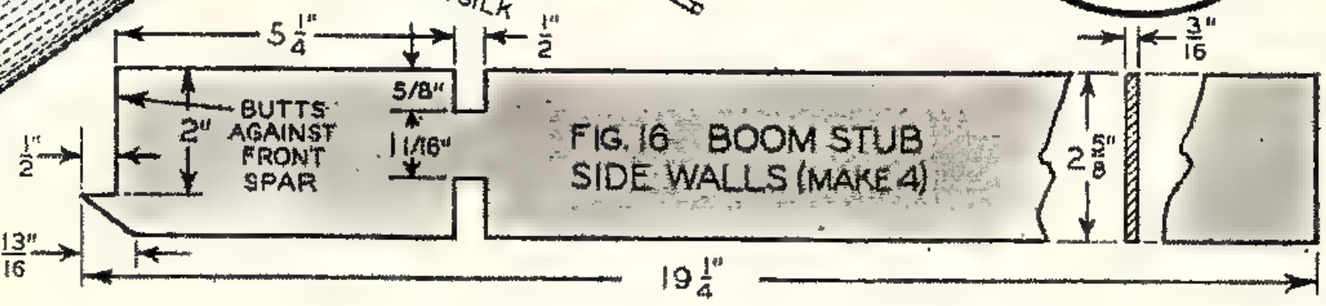


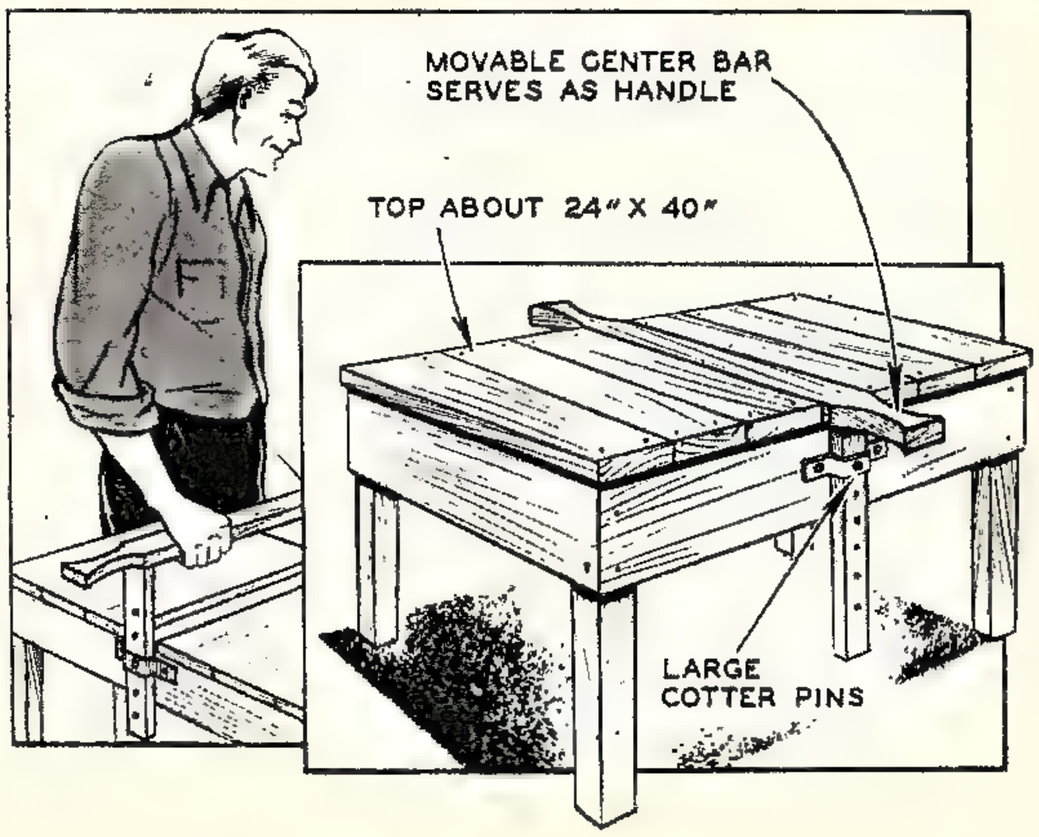
FIG. 16 BOOM STUB SIDE WALLS (MAKE 4)

The method of attaching the center section to the fuselage is shown in drawing above. Right—Details of boom-stub construction.

KINKS SIMPLIFY SHOP TASKS

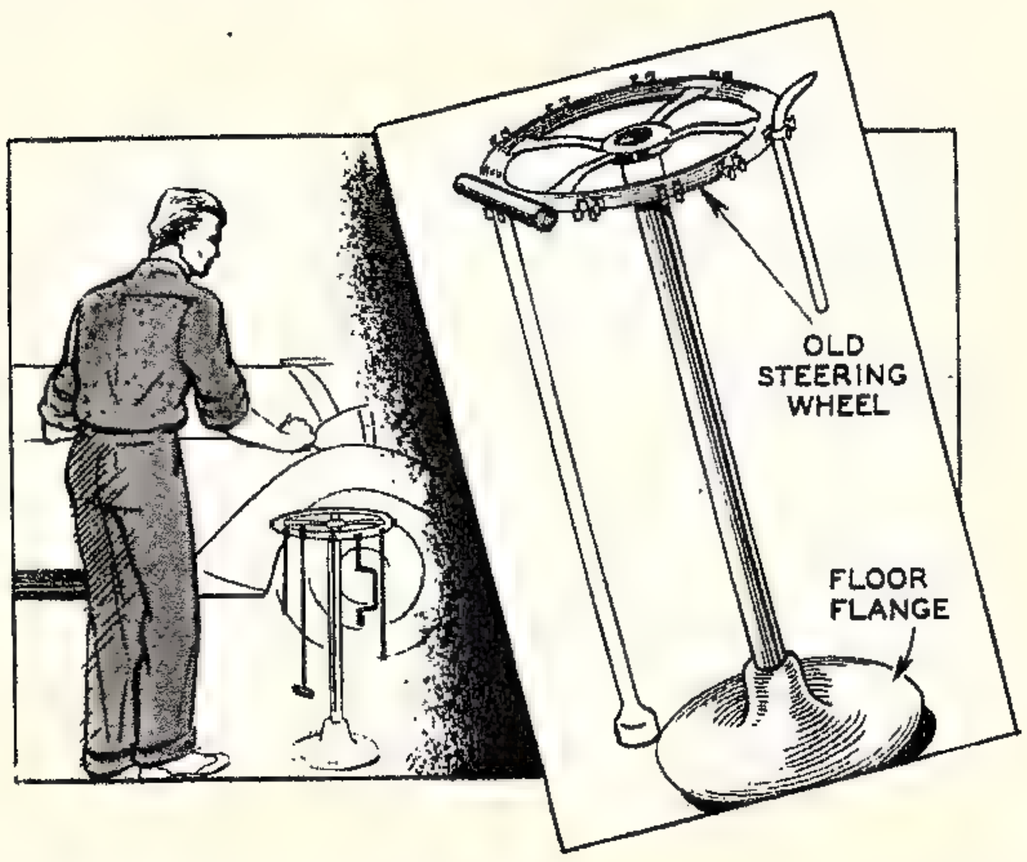
Center Bar Improves Bench

A WORKBENCH with a moveable center bar will be found very useful in the shop. The bar is supported by stakes fitting into sockets on each side, and held in any desired position by means of holes and large cotter pins. The entire table can be made quickly and easily from scrap lumber, or if bought new, at a low price. Screws should be used, but nails can be substituted if a slightly less rigid bench is not objectionable. A suitable size for the bench top is 24 by 40 inches. The center bar serves as a convenient handle when the bench is moved.—M. A. Hall.



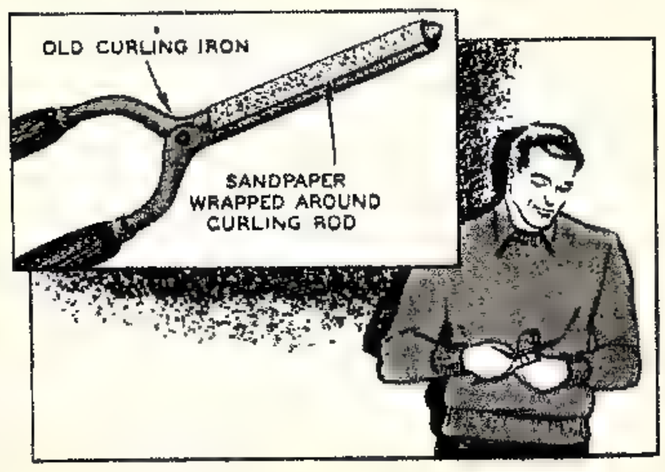
Steering Wheel Holds Tools

IN EVERY shop there are many tools or long pieces of equipment that are difficult to position so as to be handy and yet not take up too much floor space. A convenient method of solving this problem is by the use of an old steering wheel and post as shown in the drawing at the left. The post is attached to a floor flange of sufficient diameter and weight to keep it upright at all times. Clips are attached to the steering wheel which in turn is attached to the upright. The exact size and shape of the clips will depend on the type of tools to be held.—M. A. Hall.



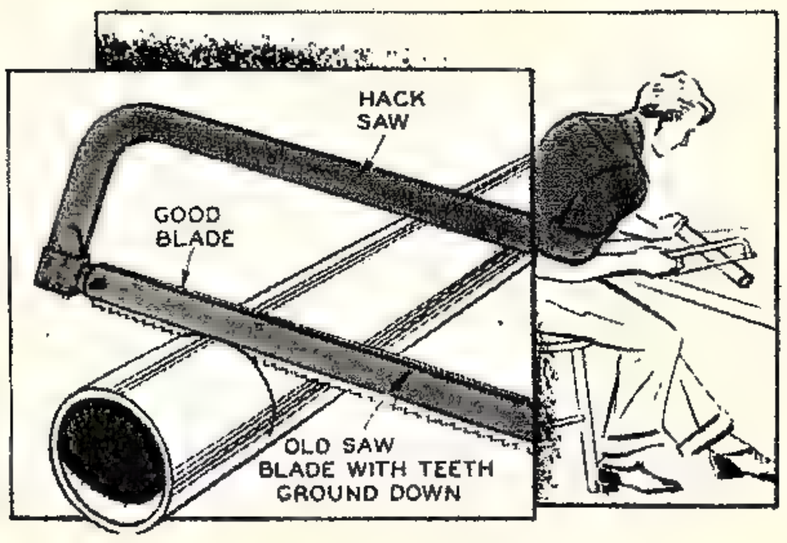
Old Hair Curler Holds Sandpaper

OLD hair curling tongs can be used as a handy holder for emery cloth or sandpaper when finishing intricate scroll work. The sandpaper is wrapped around the rod and lapped so that when the iron is closed, it will hold the paper securely in position. When one piece is worn out, it is a simple task to substitute another.—A. E. Ogren.

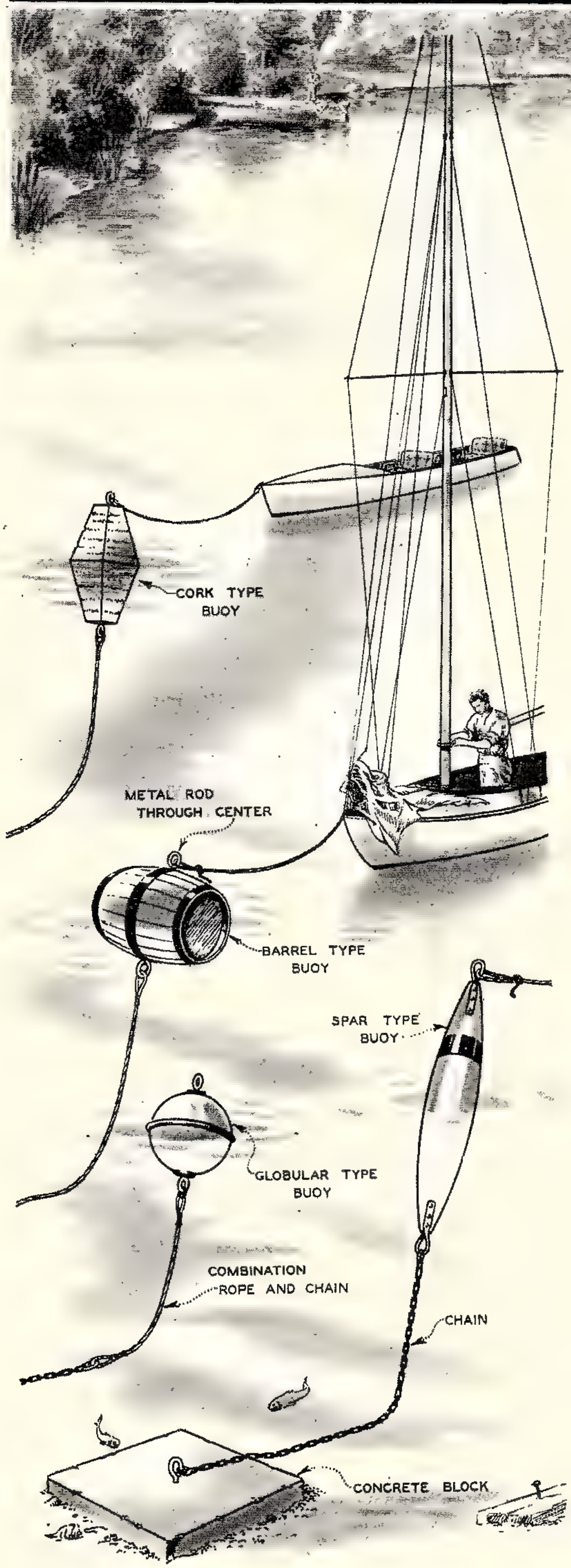


Additional Blade Helps Hack Saw

WHEN a hack saw is used to cut metal tubing, the blade often sticks, and at the same time, cuts the tubing at an incorrect angle. These problems can be eliminated if a second blade, with its teeth ground off, is fitted to the holder, along side of the cutting blade. The regular blade cuts through the tubing while the guide blade rides on top of the tubing, holding the cutting blade up and at its correct cutting angle. The guide blade can be removed easily when it is not to be used.—H. Paisley.



How To Moor



by Sam Rabl

INSURANCE statistics of marine casualities show that over forty per cent of damages paid are caused by bad anchor devices. Many an owner will lavish money on expensive fittings for his boat and then through either ignorance or a desire to save money on an accessory that is not visible will trust her future to inferior ground tackle.

There are as many kinds of anchors as there are boats; they range from the humble block of a discarded auto motor to the expensive bronze anchors of the folding type. The kedge anchor is the most common type, being what every one conceives when the word anchor is mentioned. It consists of three parts, starting from the bottom, the flukes, the shank, and the arms or stock. The function of the flukes is to dig into the mud and are the real holding power, the stock tends to keep the anchor in a position that the flukes will "bite." The shank forms the connecting bar between the flukes and the stock. Without a doubt, weight for weight, the kedge anchor has more holding power than any other type. It has a number of disadvantages, the greatest being its unwieldiness aboard a small boat. To overcome this difficulty the arms are sometimes made to slide through the shank so that it may be laid flat on the deck.

A further improvement on the kedge anchor is the folding kedge in which both the arms and flukes fold against the shank. This allows the anchor to be

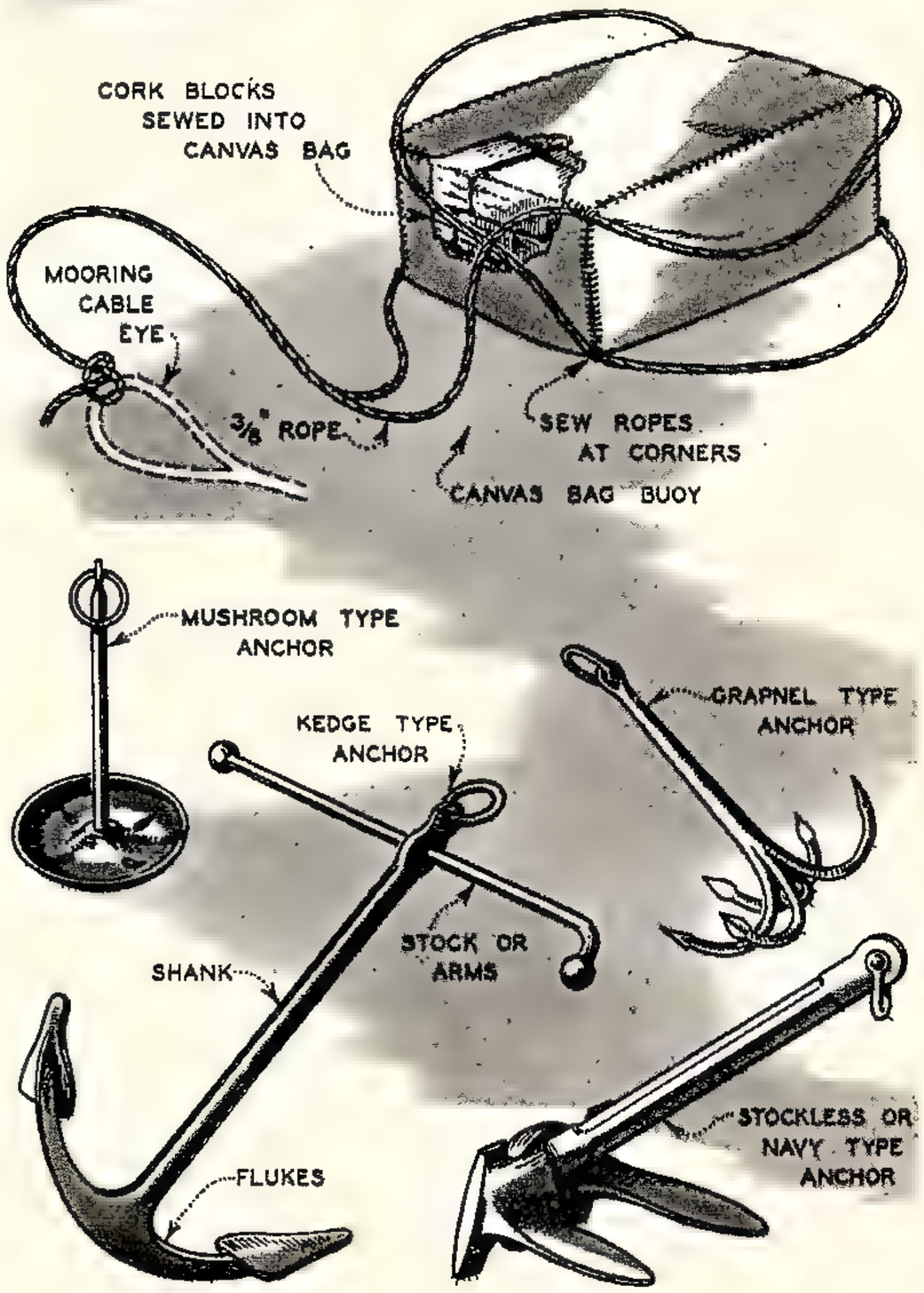
The Small Boat

stowed in a very small space. One big disadvantage of the kedge anchor is its tendency to foul on a rock bottom by having the flukes catch in a rock and stick so that the cable often has to be cut to free the vessel. Another fault is that when the boat lays at anchor in a calm and slowly rides around the anchor, the mooring cable becomes fouled on the flukes. When this happens and a blow comes up, the pull of the cable is on the flukes and the anchor pulls out. The kedge is not recommended for a permanent mooring.

To offset the disadvantages of the kedge anchor, the stockless, or Navy type anchor was invented. This type of anchor has the advantages of being easy to stow and is practically non-fouling. It has to have about thirty per cent more weight for the same holding power and must be fitted with a slightly longer cable than the kedge. The mushroom anchor has perhaps the most holding power of all the anchors in a muddy or sandy bottom and is the type that the lightships out at sea use to ride out the winter gales.

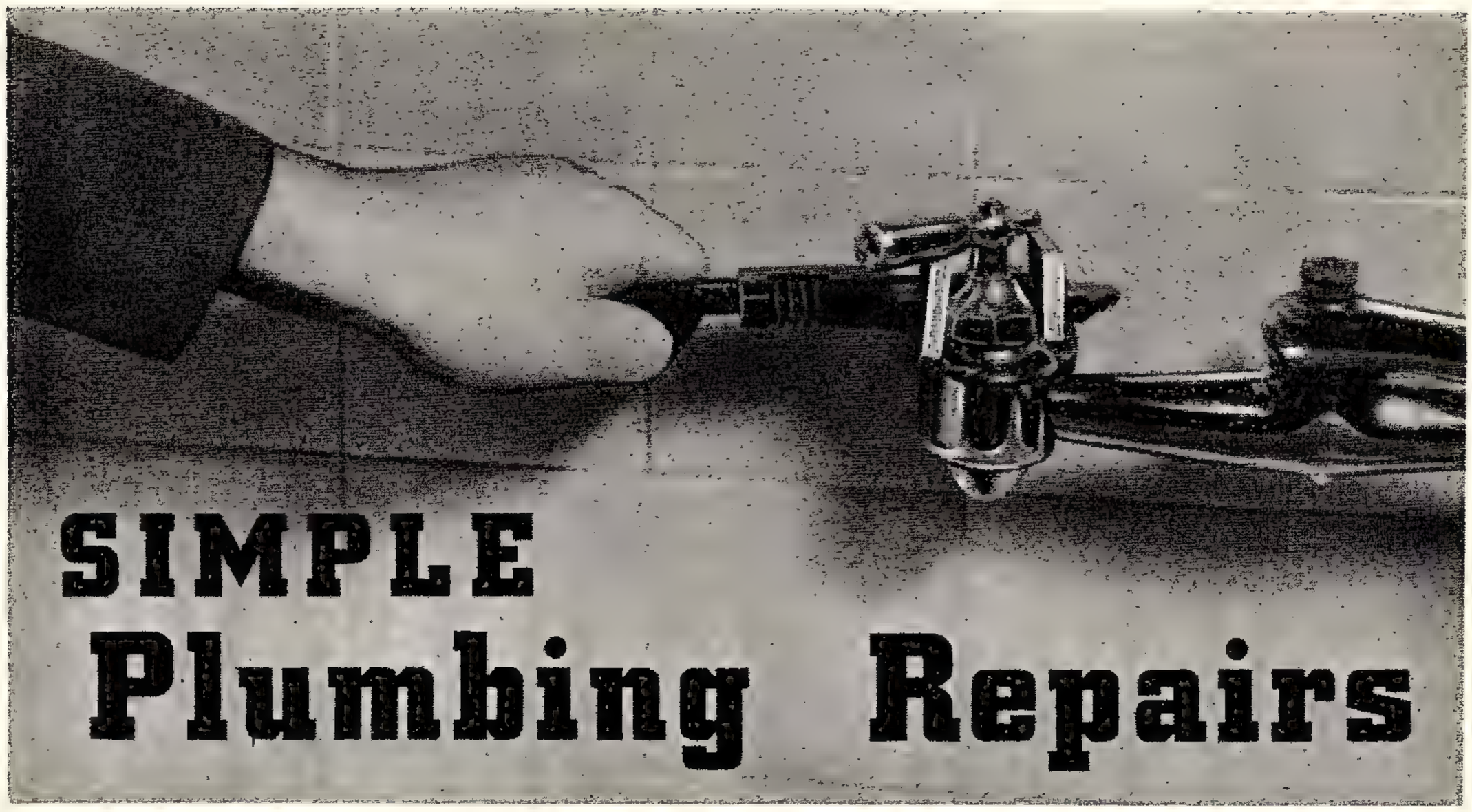
In addition to the manufactured anchors, there are other make-shift devices which

[*Continued on page* 140]



PERMANENT MOORINGS				
SIZE OF BOAT — SHELTERED HARBOR	SIZE OF BOAT — EXPOSED	SIZE OF ANCHOR — STOCKLESS OR MUSHROOM	SIZE OF ROPE	SIZE OF CHAIN
18 FT — 20 FT.	14 FT. — 16 FT.	50 LB.	3/4" DIA.	1/4"
20 FT — 25 FT.	16 FT. — 20 FT.	100 LB.	7/8" DIA.	5/16"
25 FT. — 30 FT.	20 FT. — 25 FT.	150 LB.	1 DIA.	3/8"
30 FT. — 35 FT.	25 FT. — 30 FT.	200 LB.	1 1/8" DIA.	7/16"
ANCHOR CABLE HALF CHAIN AND HALF ROPE OR ALL OF EITHER — LENGTH 20 TIMES DEPTH OF WATER				

Microscope fans who would like to inspect specimens under polarized light but have been unable to do so because of the cost, will find directions for adding the Polaroid feature to their present microscope in the September issue of MECHANIX ILLUSTRATED. An inexpensive pair of Polaroid spectacles is all that is required for opening up an entirely new field in microscopy.



SIMPLE Plumbing Repairs

The first step in replacing a worn washer is to remove the top of the faucet. The finish can be protected by using small blocks of wood between the nut and the jaws of the wrench.

The washer is held by a single screw. Replacing it takes but a minute, and only a wrench and screw driver are necessary. An assortment of all the usual sizes of washers can be purchased for a few cents in most ten-cent stores.

To clean out the trap under a sink, remove the plug at the bottom of the "U" shaped pipe. To remove solid matter, use a piece of wire and then flush out the pipes with very hot water.

HAVING gone through a long period of continual development, plumbing fixtures and installations have reached a high stage of reliability. Considering how little service the plumbing in the average house receives, it is remarkable that it gives trouble so seldom.

Probably the most common trouble is leakage of water at faucets. Aside from the total amount of water needlessly wasted this way, the steady dripping causes a chemical reaction to be established between minerals and other impurities in the water and the surface of bathtubs and wash basins. In many localities the water contains considerable impurities, and before it is realized a dirty brown streak appears on an otherwise clean white surface. Removal of these stains is very difficult, in many cases impossible. Vigorous scrubbing with a mildly abrasive cleaning powder sometimes helps if started early enough. The trouble is that the enamel surface of the tub is actually eaten away by the chemical action, and rubbing may make the trouble worse. Application of a strong bleach like Javelle Water sometimes helps.

The proper thing to do, of course, is to prevent the water from dripping. This is an extremely easy job, and does not require special plumber's tools.

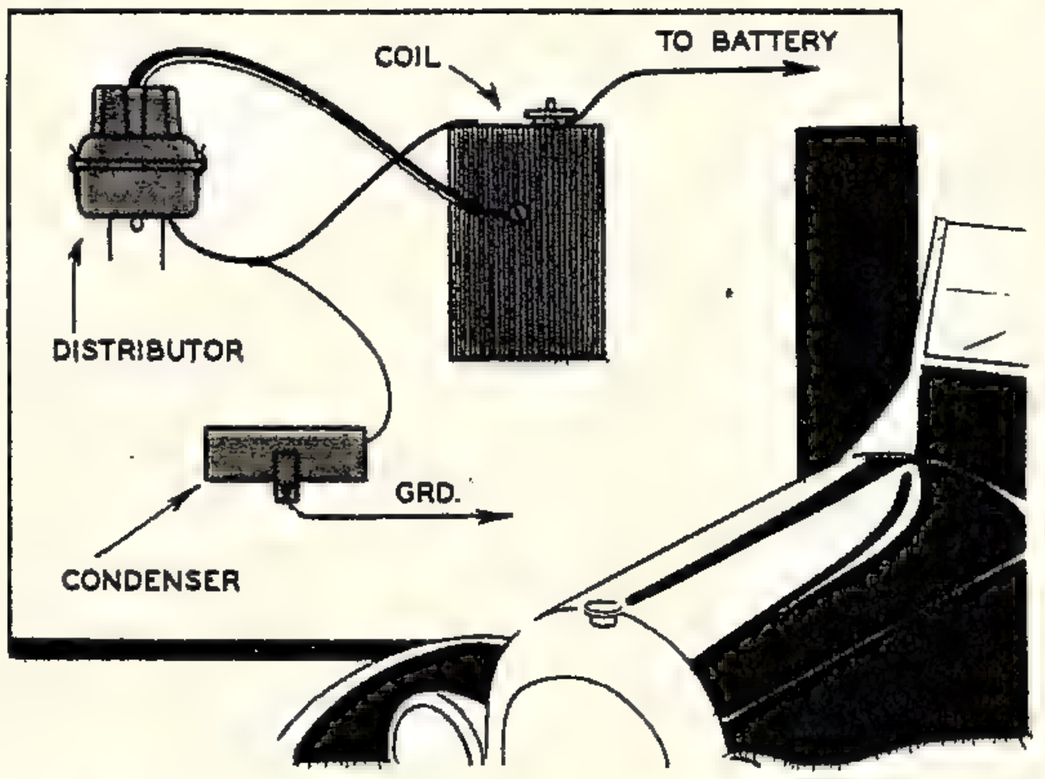
Inside the faucet is a fiber washer slightly smaller than a dime. This fits against a seat ground in the bottom of the faucet. When the faucet is turned "off," this washer squashes itself flat and prevents water from flowing.

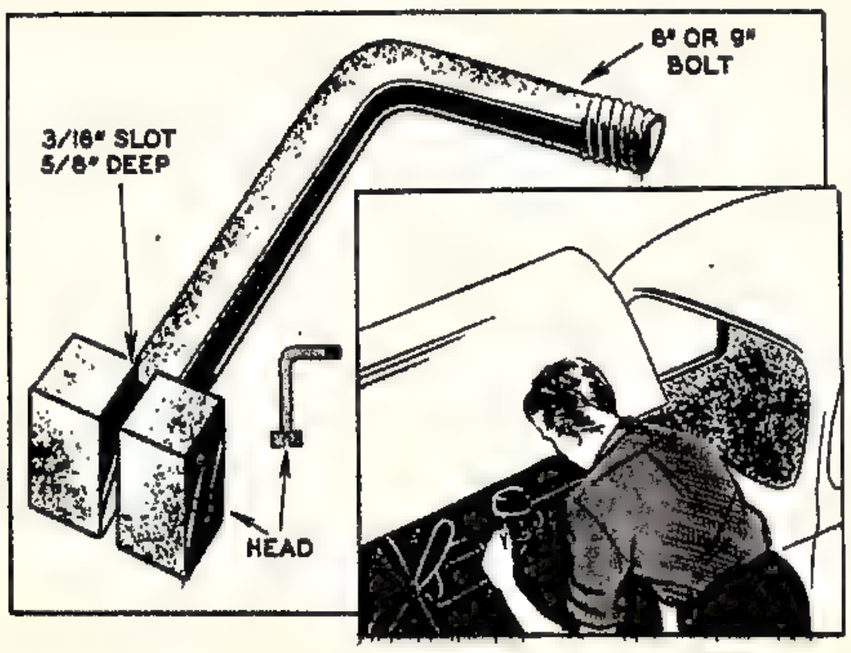
[*Continued on page* 140]

TIME SAVING AUTO KINKS

New Condenser Aids Coil

WHEN old style ignition coils used in cars of ten years ago burn out, many times it will be found that the coil actually is intact but the built-in condenser has blown. When this happens an ordinary ignition coil condenser can be connected as shown in the diagram at right, and the trouble usually will be found to be corrected. These condensers can be purchased at almost any auto supply store. Be sure that the ground lead is connected securely to the car frame. This is necessary for satisfactory operation of the ignition coil.



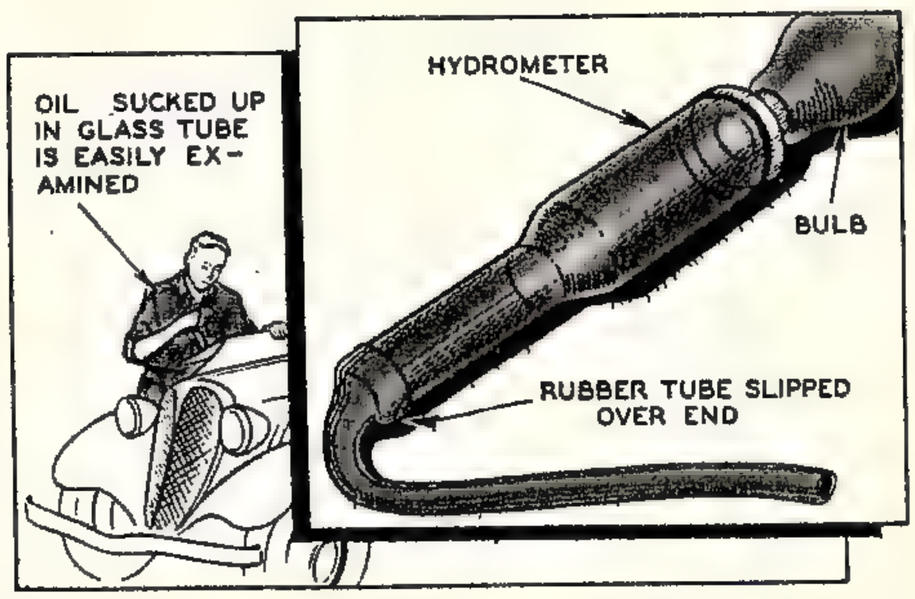


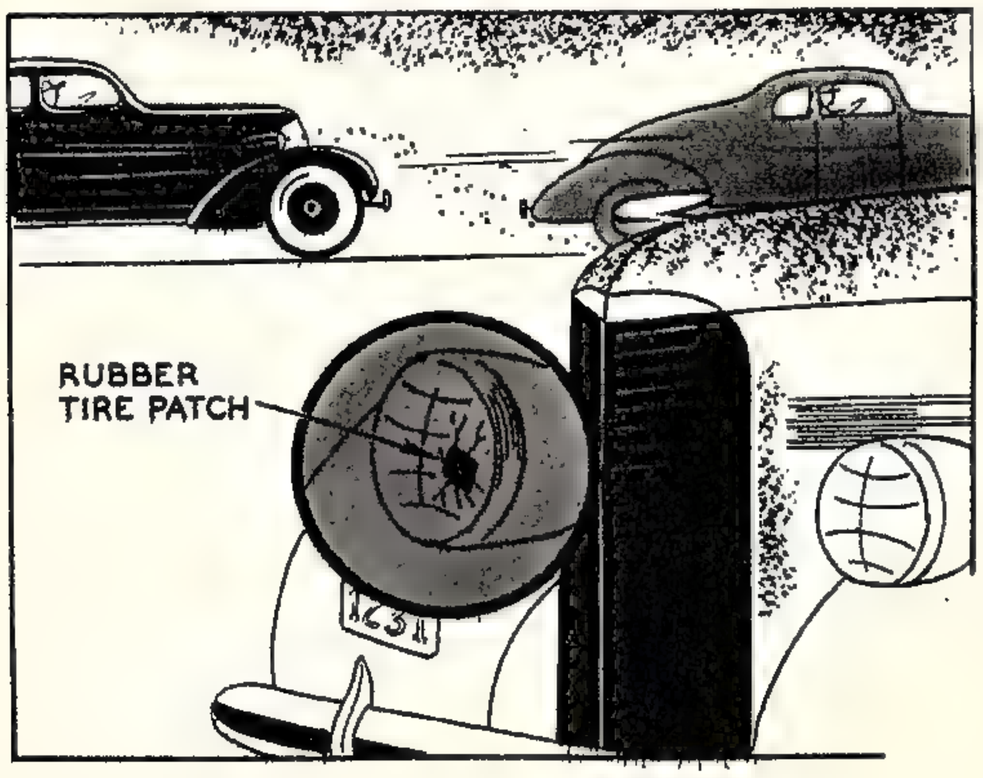
Slotted Bolt Loosens Tight Tap

BECAUSE most auto radiators are not drained often, the drain tap usually is difficult to turn. Because of its position, pliers sometimes cannot be used easily. However, a bolt 8 or 9 inches long, with a square head, can be turned into a handy tool for this purpose. The head should be slotted $\frac{3}{16}$ of an inch wide and $\frac{5}{8}$-inch deep. The position of the bend in the bolt should be regulated by the location of the tap to be turned.—Alfred Ibbotson.

Hydrometer Case Aids Oil Check

THE examination of crankcase oil is difficult unless a small portion is drained out from the plug on the under side. The inspection rod usually does not take out a sufficient quantity to make the examination satisfactory. However, the problem of opening the drain plug to obtain the oil can be eliminated by using a hydrometer case and bulb to draw up a small quantity of oil through the inspection rod hole.—A. H. Waychoff.





Tire Patch Protects Headlight

AN ORDINARY tire patch makes a good emergency repair of headlight lenses when the entire lens is not smashed. Because the reflector often is damaged when a lens is broken by the dirt and dust deposited on the surface, immediate repair of the hole is necessary. At the same time, the patch will hold the pieces of glass in place, preventing the entire lens from falling out. The patch will not interfere seriously with illuminating ability of headlight, and will remain in place for a long period of time or until a new lens can be obtained.—Harvey Paisley.

Build this Practical GARDEN BARROW

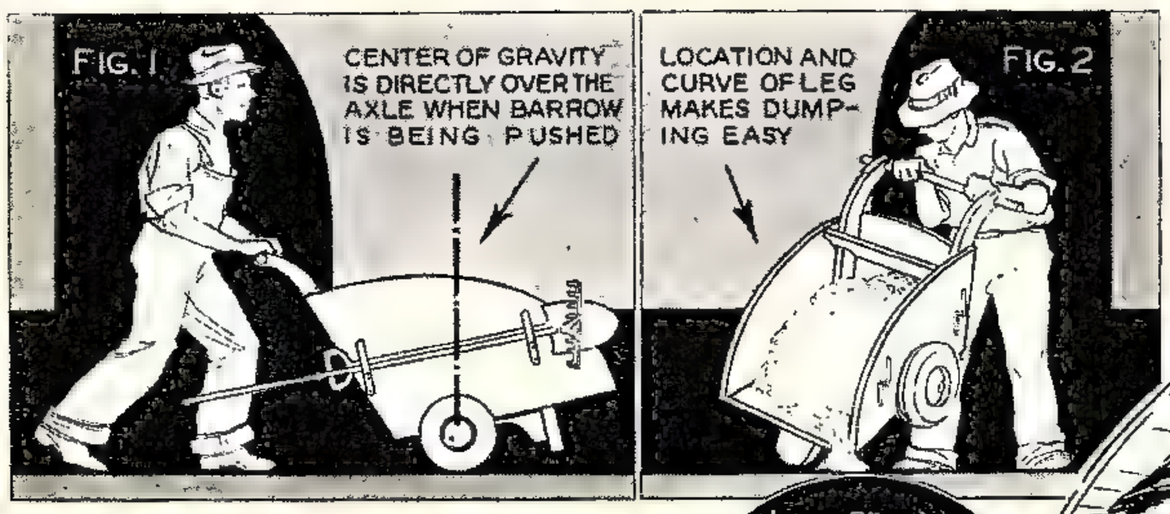


FIG. 1
CENTER OF GRAVITY IS DIRECTLY OVER THE AXLE WHEN BARROW IS BEING PUSHED
FIG. 2
LOCATION AND CURVE OF LEG MAKES DUMPING EASY

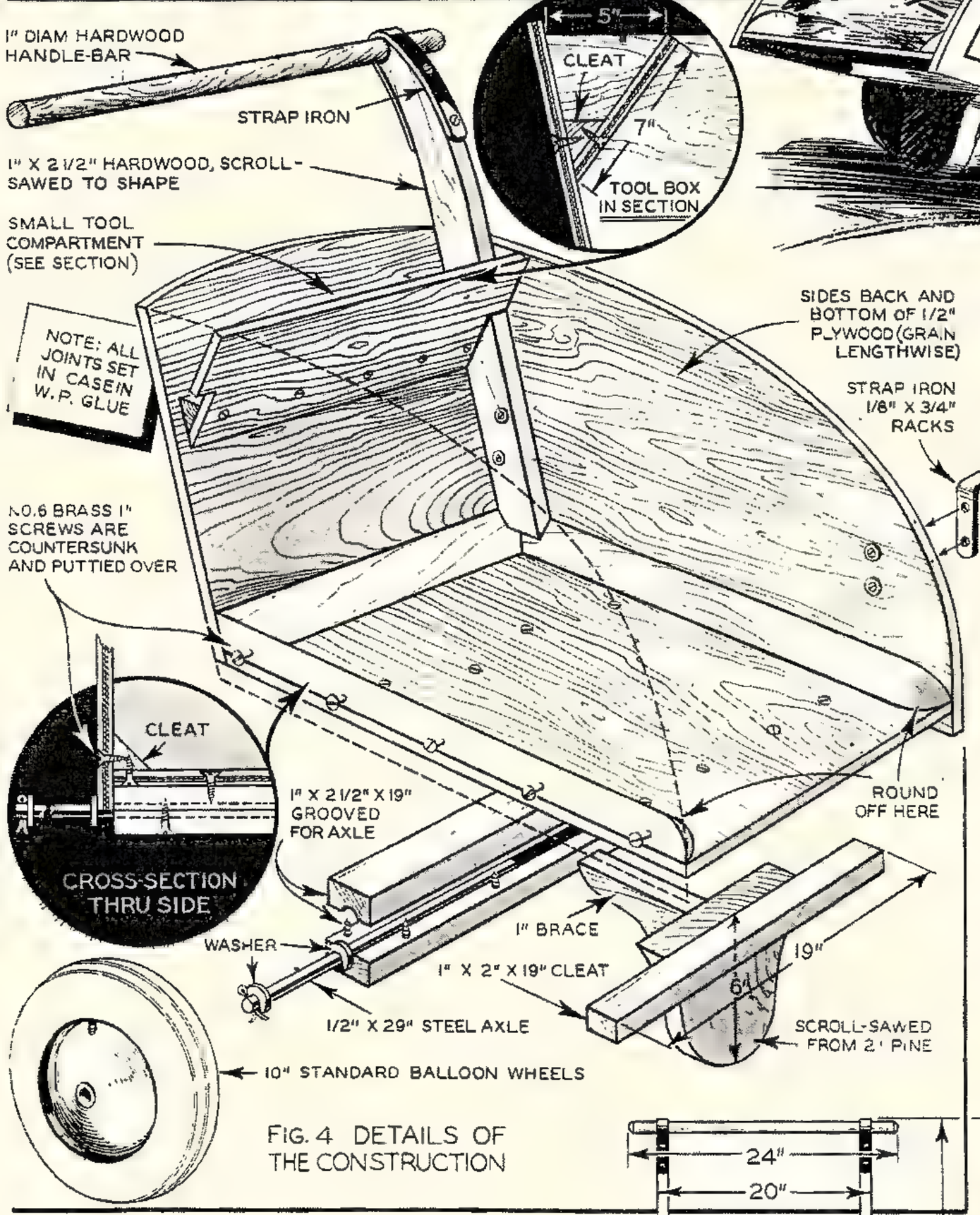

1" DIAM HARDWOOD HANDLE-BAR
STRAP IRON
1" X 2 1/2" HARDWOOD, SCROLL-SAWED TO SHAPE
SMALL TOOL COMPARTMENT (SEE SECTION)
5"
CLEAT
7"
TOOL BOX IN SECTION
NOTE: ALL JOINTS SET IN CASEIN W. P. GLUE
SIDES BACK AND BOTTOM OF 1/2" PLYWOOD (GRAIN LENGTHWISE)
STRAP IRON 1/8" X 3/4" RACKS
NO.6 BRASS 1" SCREWS ARE COUNTERSUNK AND PUTTIED OVER
CLEAT
1" X 2 1/2" X 19" GROOVED FOR AXLE
CROSS-SECTION THRU SIDE
WASHER
1" BRACE
1" X 2" X 19" CLEAT
1/2" X 29" STEEL AXLE
ROUND OFF HERE
19"
6"
SCROLL-SAWED FROM 2" PINE
10" STANDARD BALLOON WHEELS

FIG. 4 DETAILS OF THE CONSTRUCTION

A study of the accompanying sketches and a few simple hand tools are all that is required to build this large-capacity garden barrow. Paint the barrow in some bright contrasting colors.

Fig. 3. Half-inch plywood is used for the body of the barrow, but harder woods are used for other parts as indicated in the perspective cut-away drawing, Fig. 4. Be sure the grain on the bottom of the body runs lengthwise so it will not become scuffed by the shovel. The balloon-type wheels, which are available commercially, withstand a load of 200 pounds and will not injure the lawn.

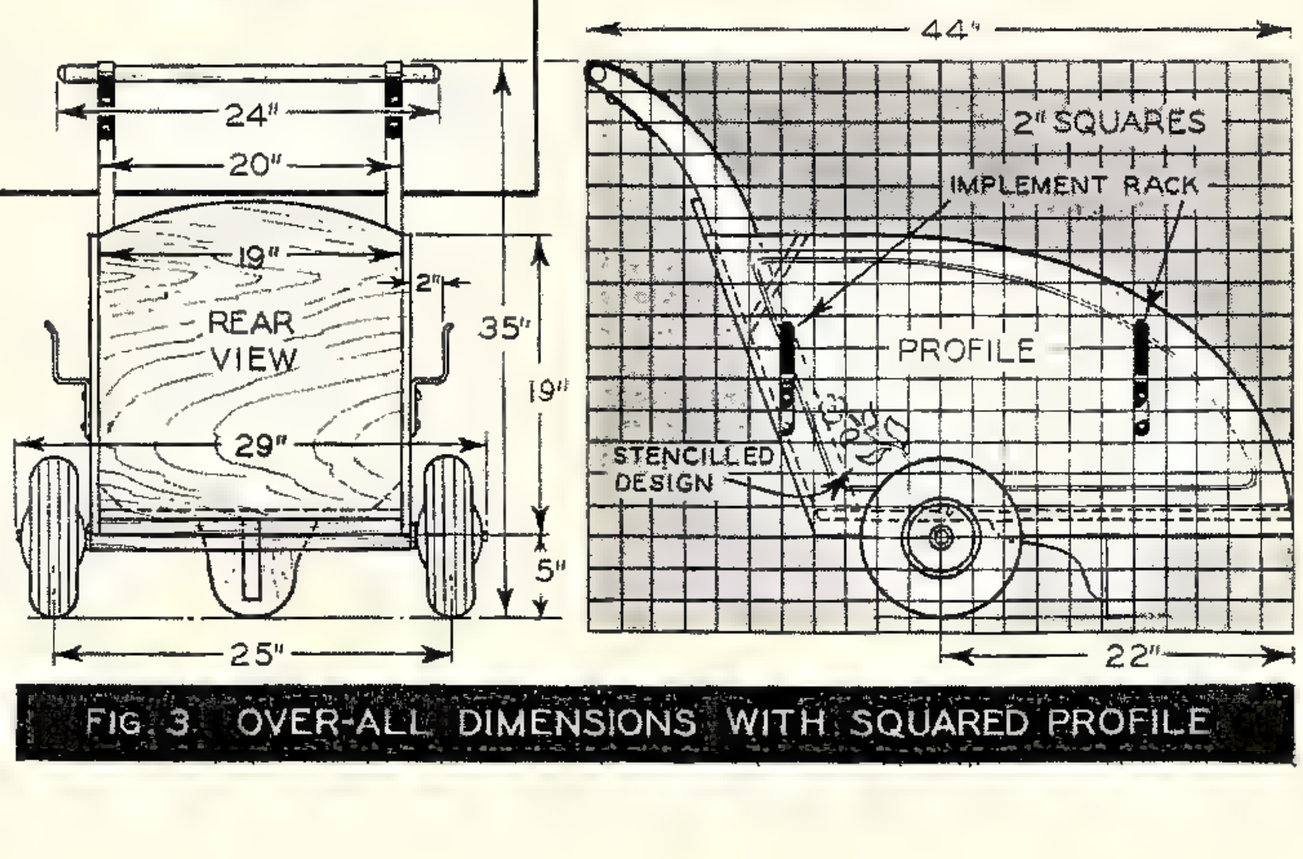


FIG. 3. OVER-ALL DIMENSIONS WITH SQUARED PROFILE

RIDING on a pair of small balloon wheels located directly under the center of the load and fitted with a single rounded leg placed near the center of load, reducing the effort required for dumping to a minimum, this garden barrow is very easy to handle and—easy to build.

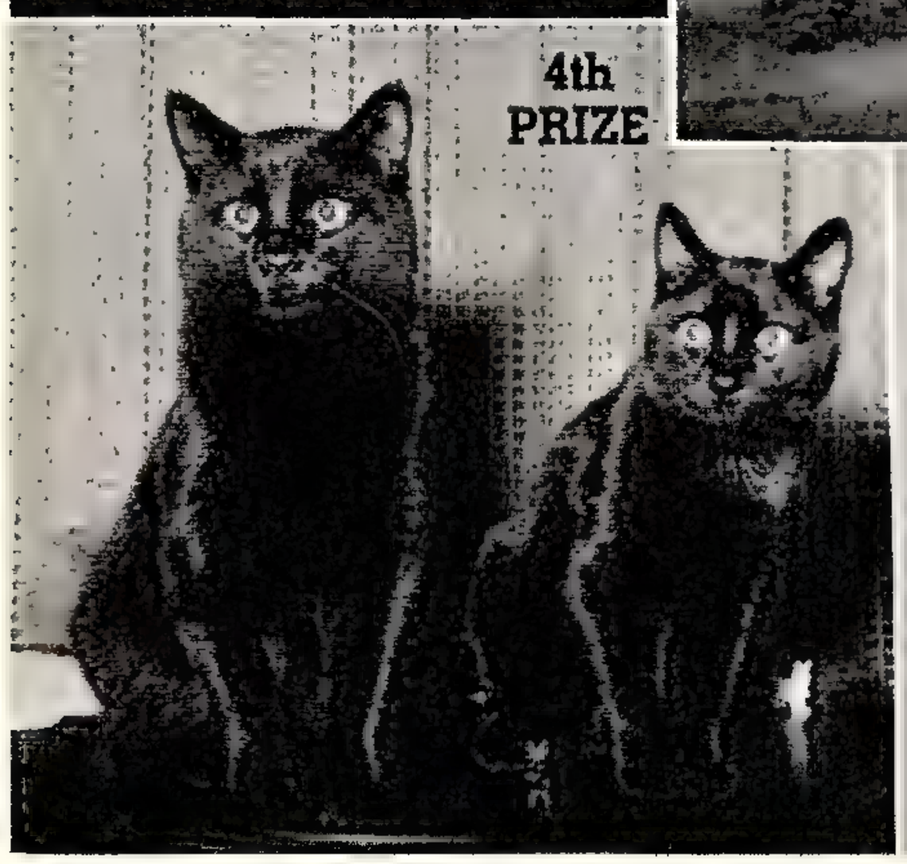
General dimensions are shown in

MECHANIX ILLUSTRATED PHOTOGRAPHY

SECTION

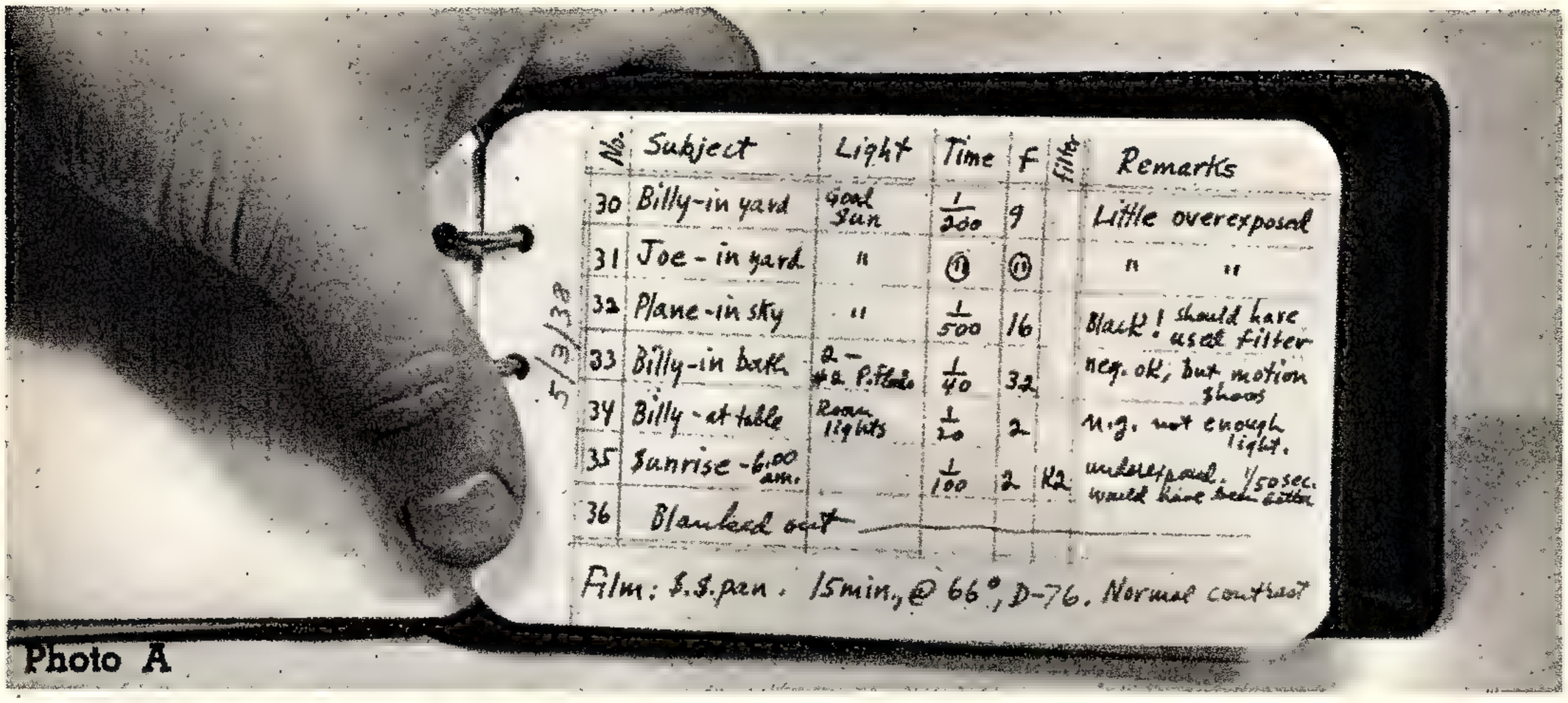
PAGES 119-132

FIRST PRIZE: "Crash" by R. S. MacNeill, Shelley, B. C., Canada. 116 Kodak, No. 1 lens stop, 1/25 sec. SECOND PRIZE: "Water" by W. Honicke, Meyerton, Transvaal, South Africa. Taken in a region where water is scarce and taps are left open for birds. THIRD PRIZE: "Celebration" by G. M. Grainger, Richmond, N. S. W., Australia. Graflex, 1 sec. at f-8 on Agfa I. S. S. film. FOURTH PRIZE: "Black Beauties" by J. Linfor, Middlebury, Ind. Eastman Valenda and portrait lens, photoflash at f-8 on panatomic, developed in D-76. FIFTH PRIZE: "Fun in a Bath" by C. Sandstorm, St. Paul, Minn. Contax, f-5.6, 1/50 sec. Two No 2 photofloods. Developed in Champlin 15.



MONEY FOR YOUR PICTURES!

Get busy with your camera and send in unusual pictures of people, animals, machines, trains, airplanes,, etc. Each month we will pay $15 for the best picture received from readers, $10 for the second choice, and $5 each for the next three selections. Prints should be glossy, as large as possible up to 8x10 inches (although a small, clear photo is more desirable than a big fuzzy one) and should be accompanied by the following data: make and size of camera, type of film, and how developed and printed, lens opening and shutter speed, and lighting conditions. Wrap all prints carefully, put your name and address on each, and include postage if you want them returned. Address all contributions to Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y.


5/3/38
No. Subject Light Time F filter Remarks
30 Billy-in yard Good Sun 1/200 9 Little overexposed
31 Joe - in yard " " " " "
32 Plane-in sky " 1/500 16 Black! should have used filter
33 Billy-in bath 2 - #2 P.flds 1/40 32 neg. ok, but motion shows
34 Billy - at table Room lights 1/20 2 n.g. not enough light.
35 Sunrise - 6:00 a.m. 1/100 2 K2 underexposed. 1/50 sec. would have been better
36 Blanked out
Film: S.S. pan. 15 min, @ 66°, D-76. Normal contrast
Photo A

KEEP A RECORD

by Robert Hertzberg

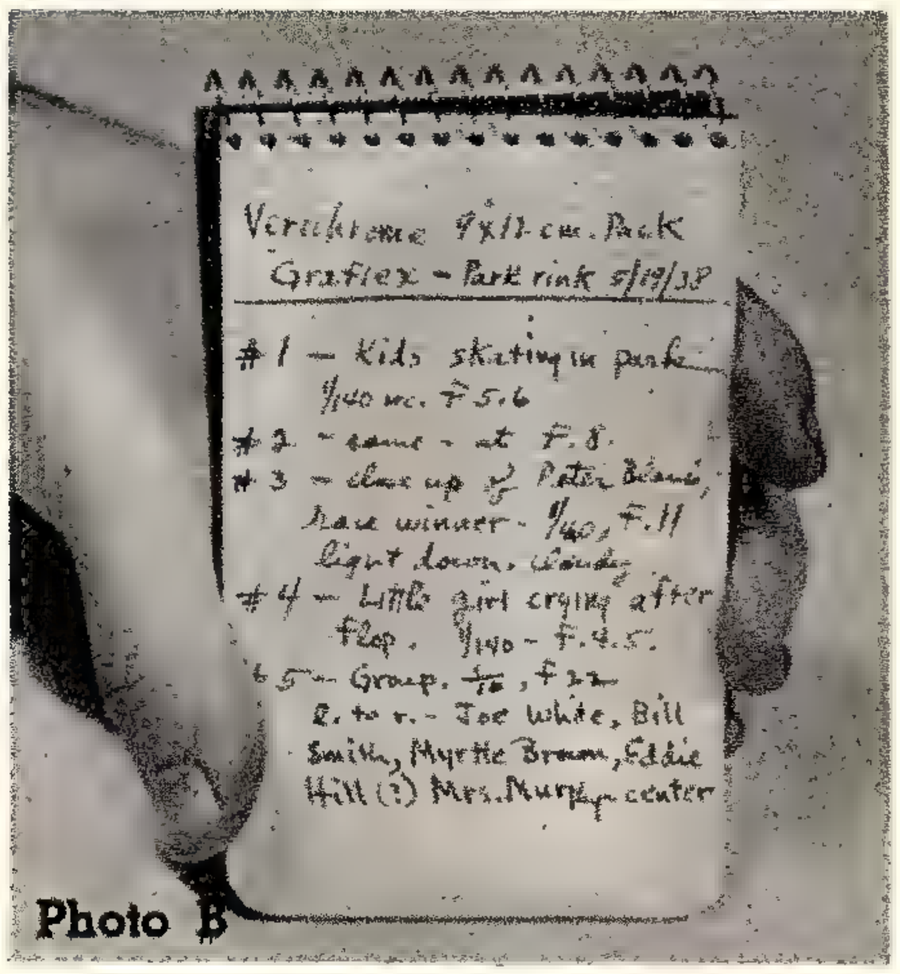
DID you ever develop a roll of film after it had been in the camera for a month, discover you had several perfectly wonderful pictures, and then wonder what shutter speed and diaphragm opening you used and how the light was? If your camera is a miniature using 36-exposure rolls, you may even have difficulty remembering who or what the subjects of the early frames are, for a 36-picture film lasts a long time!

The answer to this minor problem in photography is an exposure record, in the form of notations made on a card, a loose slip of paper, or best, of all, in a small pocket note book. At first this bookkeeping is something of a nuisance, but as time goes on you will find the records of increasing value as a check-up of your ability with the camera. By comparing the data of good pictures against the records of the poor ones, you will learn how to avoid errors, and your sense of picture quality will become sharper. In other words, you'll learn how to turn out good photographs, and that's the general purpose of camera work.

The simpler and more convenient the exposure record, the more inclined will you be to make a habit of its use. Visit a stationery store and buy a note book small enough to fit in the vest or breast pocket. A loose-leaf or spiral-bound book measuring about 3 by 5 inches is just right. Cross-section paper is best, as the light blue lines provide a writing guide with the book held either vertically or horizontally.

A few minutes spent in ruling the pages neatly will save time and temper later. Photograph A shows an arrangement that the writer has found practicable and convenient. Each page is ruled lengthwise to form seven columns about $\frac{5}{16}$" deep. From left to right, the headings read: No. (for the number or the frame), subject, light, time, (meaning shutter speed in fractions of a second), F, (indicating diaphragm stop), filter, and remarks. The last column is filled in after the roll has been developed and printed and the resulting pictures have been examined with a critical eye. At the bottom is a notation of the kind of film. This is extremely important, as most makes of film have no identifying marks, and once they have been

[*Continued on page* 142]

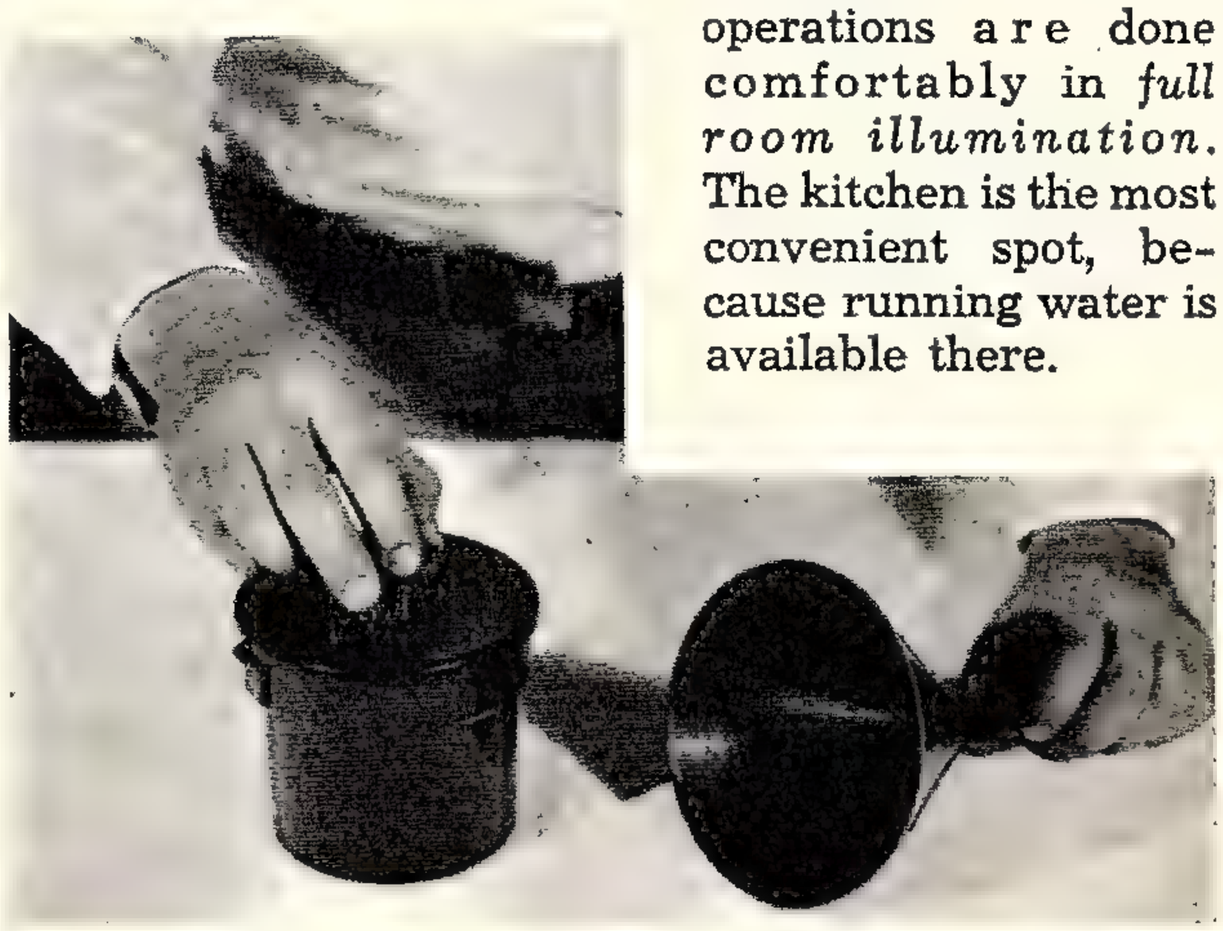

Verichrome 9x12 cm. Pack
Graflex - Park rink 5/19/38
#1 - Kids skating in park
1/100 sec. F 5.6
#2 - same - at F.8.
#3 - close up of Peter Brand,
race winner - 1/40, F.11
Light down. Cloudy
#4 - Little girl crying after
flop. 1/40 - F.4.5.
#5 - Group. 1/10, f 22
L. to r. - Joe White, Bill
Smith, Myrtle Brown, Eddie
Hill (?) Mrs. Murphy center
Photo B

Tank Developing Simplified

No. 1: Load tank in complete darkness if panchromatic film is used, or under No. 2 red safelight with ortho film. Waste one roll of films by opening it in daylight and seeing how it is assembled; then use it for practice loading. Load film according to instructions with your particular tank. Close tank and turn on light.

No. 2: Filter amount of developer required by tank, using wad of cotton in large funnel. Old fruit jar better than bottle; supports funnel more securely. Adjust developer temperature by immersing jar in hot or cold water. Most formulas call for 65 degrees F.

No. 3: Rinse funnel well. Note time, then pour in developer slowly, giving air plenty of time to escape. Rinse funnel and jar thoroughly, invert on sink to drain.



No. 4: Twirl inside reel slowly half dozen times first minute, again during each of the next five minutes, and then every other minute until developing time is over. This is very important; undisturbed developer sometimes spots films.

PEOPLE who have not kept up with recent advances in photography have an idea that the job of developing a roll of amateur film is a messy and tedious one, and requires several hours of labor in an airtight darkroom. As a matter of fact, a regular darkroom isn't even necessary, providing any one of the numerous "daylight" tanks now on the market is used.

The loading of the film into the tank is the only operation that must be performed in the dark. This takes about one minute, and can be done in any clothes closet as long as no direct light strikes the edges of the door. In the evening, when most amateurs do their work anyway, the closet will be pitch black. With the tank covered, ALL other operations are done comfortably in *full room illumination*. The kitchen is the most convenient spot, because running water is available there.

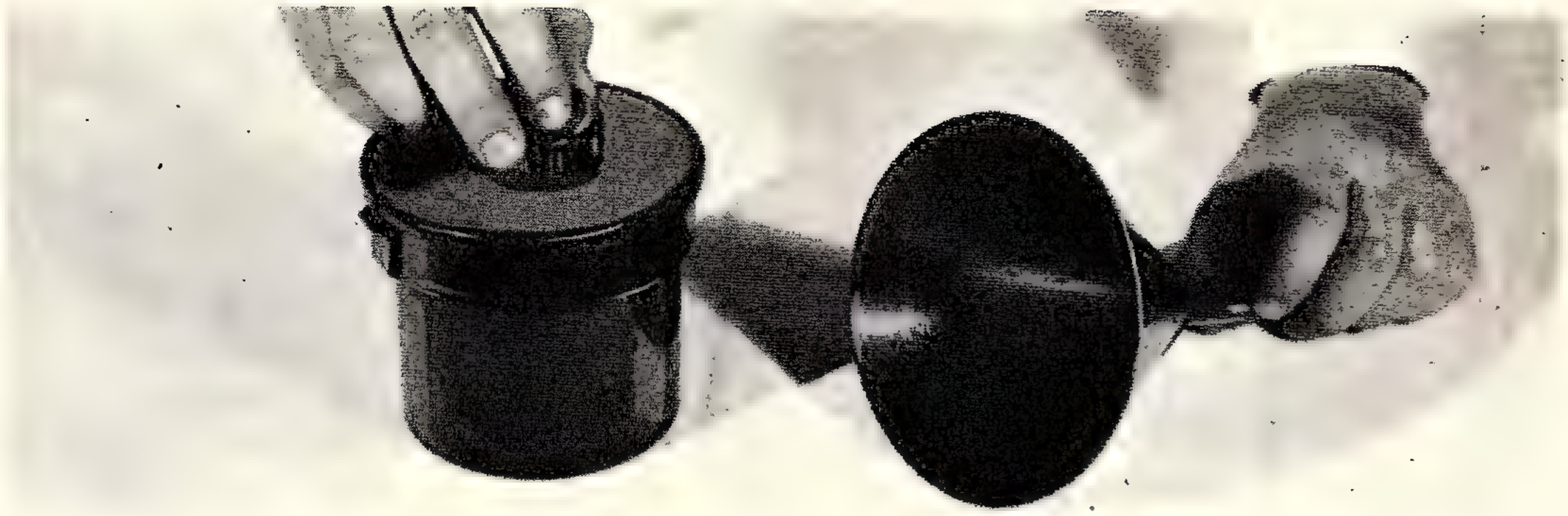
No. 5: While film is developing, filter correct amount of hypo, after rinsing funnel and jar a second time. Give tank a twirl occasionally. Adjust hypo temperature to same warmth as developer, or at least within one or two degrees, by immersing jar in hot or cold water, as required.

No. 7: Adjust running water to developer temperature. Rinse out tank four or five times (with lid on!) to remove all traces of developer. If no running water is available rinse with water from bottle; empty into pail or another bottle.

No. 8: Empty tank after each filling with water. Thorough water-wash very important. If developer is left on film, action of hypo on it sometimes causes "pinholes".

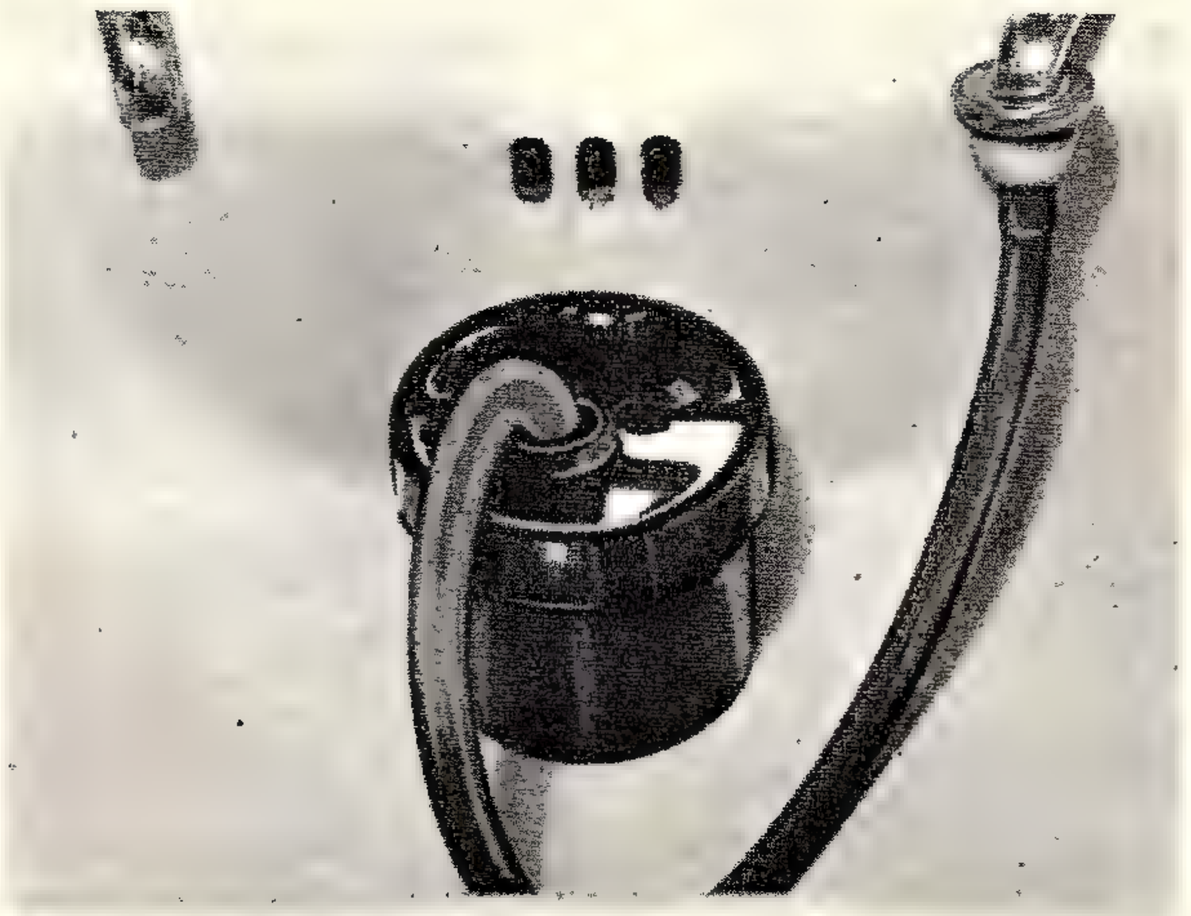
No. 6: After developing time has elapsed, pour developer back into bottle, using thoroughly rinsed funnel. Most fine-grain developers can be used over and over if kept in tightly corked bottles. Screw caps are better than ordinary corks; latter tend to jump out if bottle is full.

No. 9: After tank is drained of water, pour in hypo (previously filtered). Pour slowly to prevent splashing. Note time. Leave hypo in 15 minutes; this is standard regardless of type of film or developer.

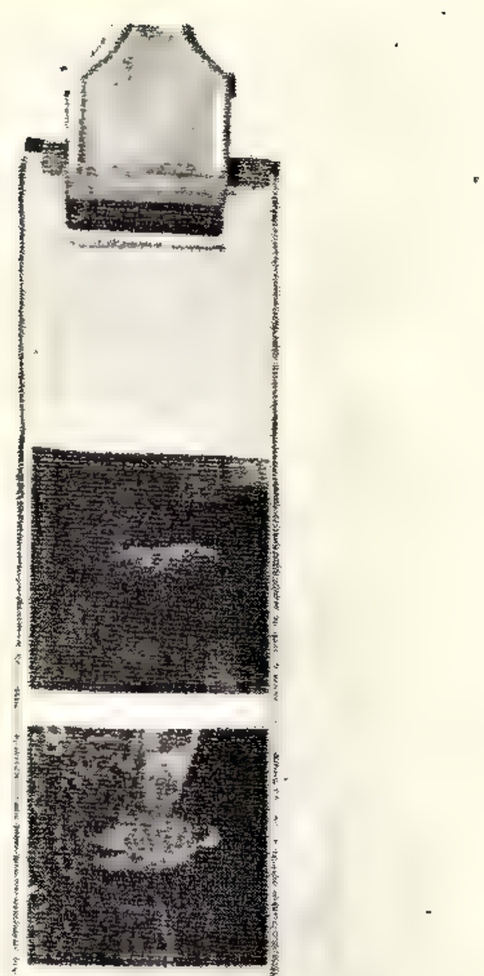


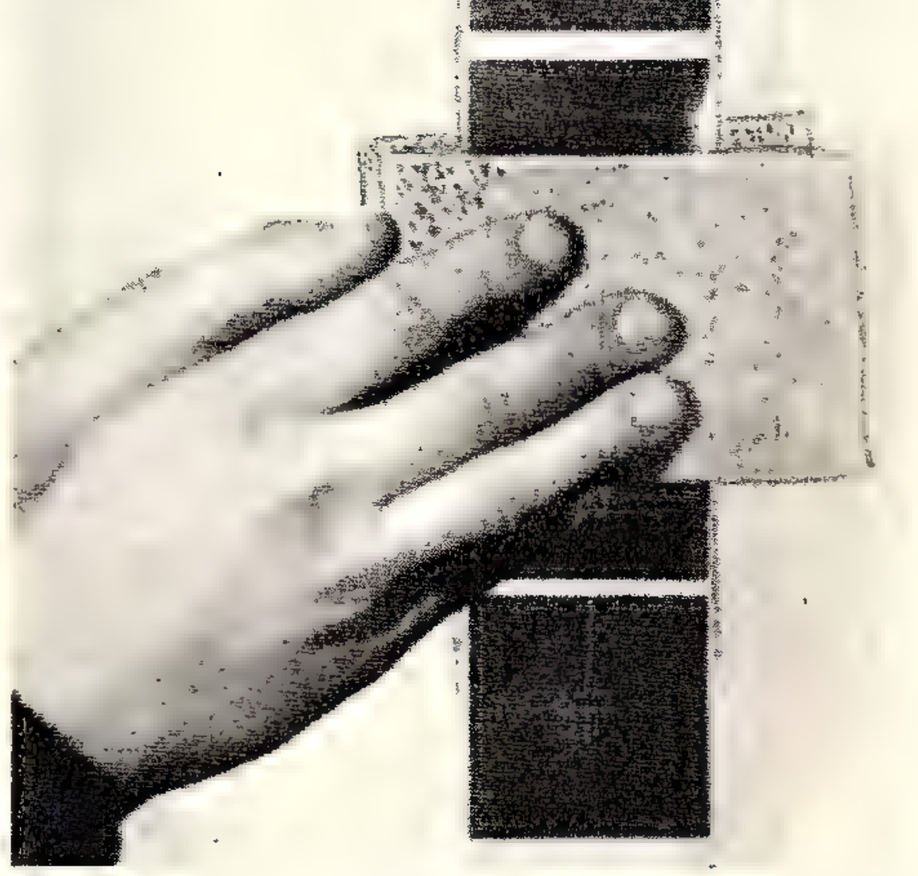
No. 10: After pouring in hypo, twirl reel slowly for one minute; then again once every minute for five minutes. Agitation during both developing and fixing will eliminate streaking and other blemishes on the film.

No. 11: After 15 minutes, pour hypo back into original bottle. A half-gallon of hypo will fix about two dozen average size roll films. Don't save it too long; it's cheap and easy to mix. Same hypo can be used later to fix prints—either contact or enlarged.



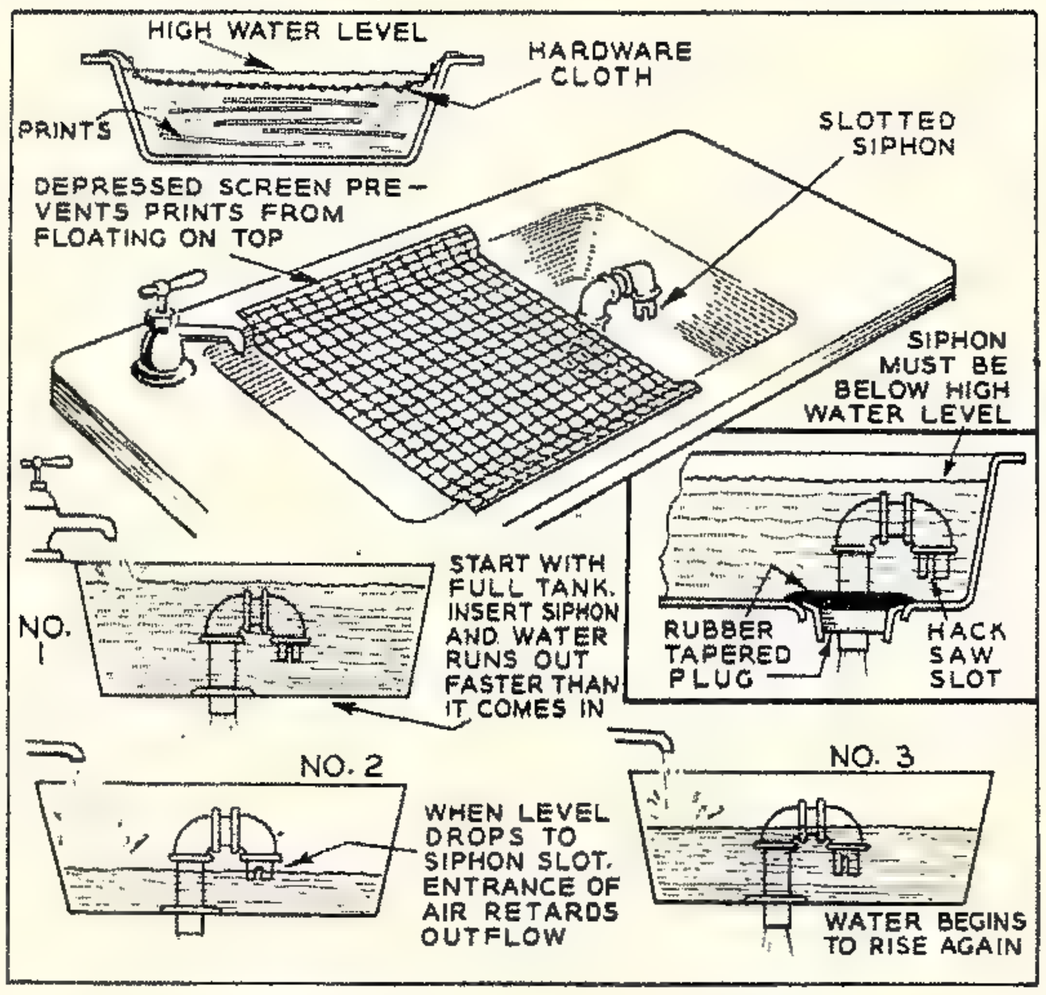
No. 12: Wash film thoroughly with cold water, using short piece of rubber hose and faucet adapter. Take out film reel occasionally to break up any bubbles forming on it. Wash for minimum of 15 minutes; 20 to 30 minutes will remove all traces of hypo and leave film perfectly clean.





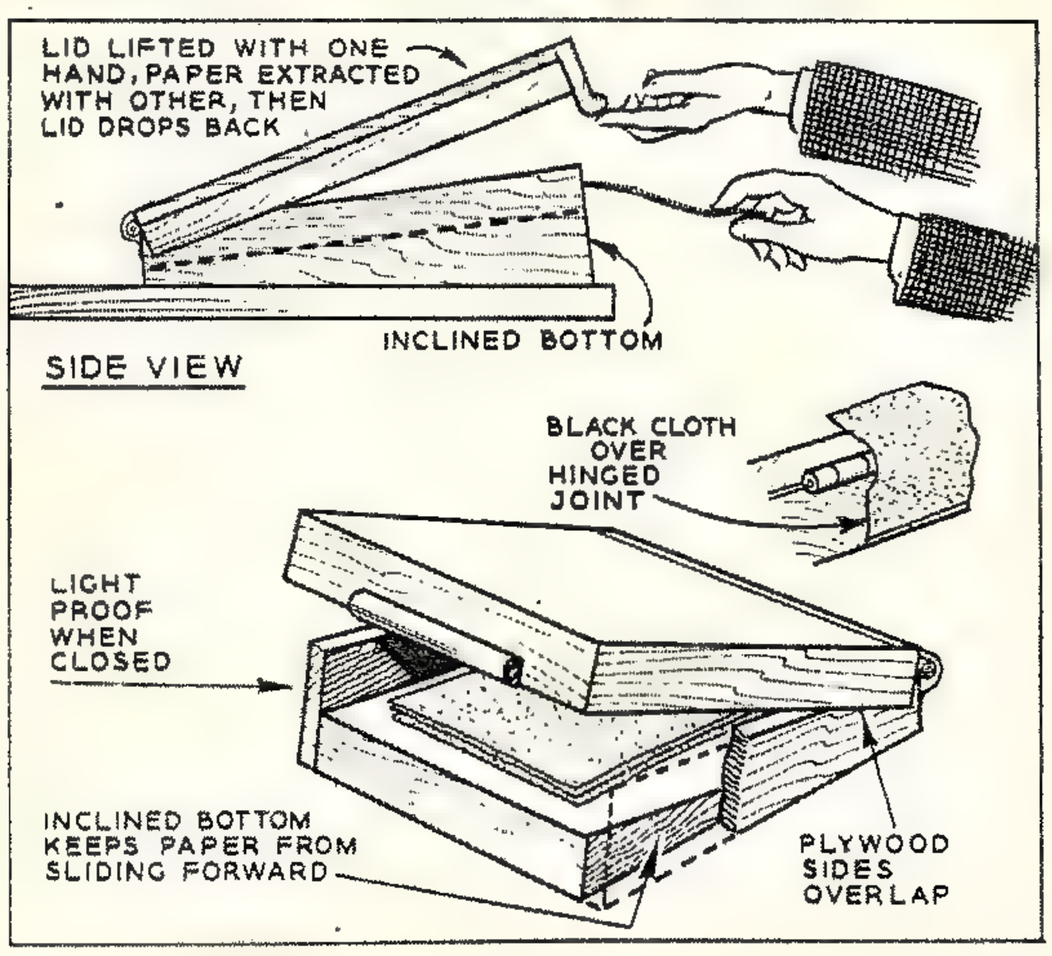
No. 13: Unwind film from reel, hang in dust-free spot. Wet two halves of viscose sponge (made specially for film drying); squeeze out, then make sandwich with film between. Start at top, and wipe down evenly. Squeeze out sponges again, wipe downward second time. Film will then dry perfectly clean without spots or streaks. When dry, handle only by its edges.

Variable Level Print Bath

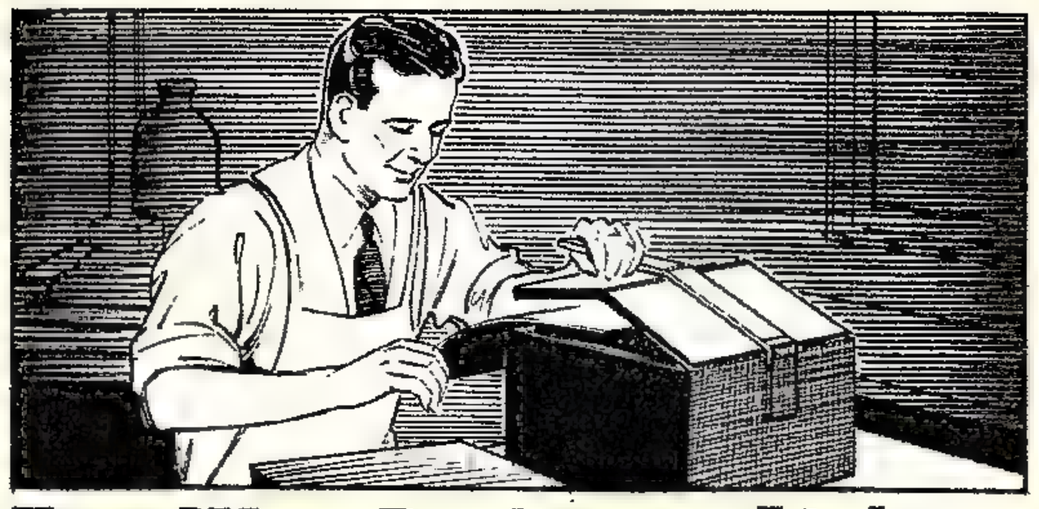

HIGH WATER LEVEL
HARDWARE CLOTH
PRINTS
SLOTTED SIPHON
DEPRESSED SCREEN PREVENTS PRINTS FROM FLOATING ON TOP
SIPHON MUST BE BELOW HIGH WATER LEVEL
START WITH FULL TANK. INSERT SIPHON AND WATER RUNS OUT FASTER THAN IT COMES IN
NO. 1
RUBBER TAPERED PLUG
HACK SAW SLOT
NO. 2
WHEN LEVEL DROPS TO SIPHON SLOT, ENTRANCE OF AIR RETARDS OUTFLOW
NO. 3
WATER BEGINS TO RISE AGAIN

A DEPRESSED screen of hardware cloth over a print bath prevents prints from floating on the surface. It may be used in any bath and is also convenient with a siphon arrangement as shown. This method of washing keeps prints in motion and the siphon carries off hypo which sinks to the bottom, thus keeping water clear.

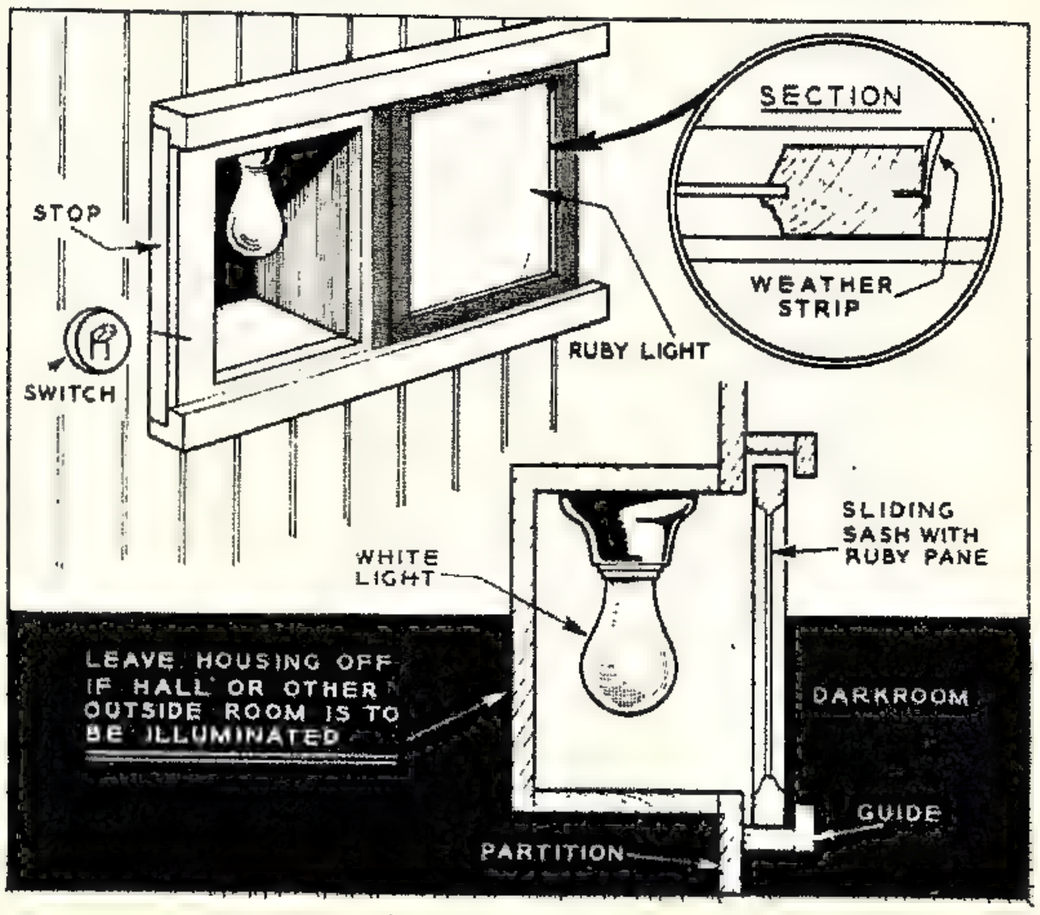
Light Proof Paper Box


LID LIFTED WITH ONE HAND, PAPER EXTRACTED WITH OTHER, THEN LID DROPS BACK
INCLINED BOTTOM
SIDE VIEW
BLACK CLOTH OVER HINGED JOINT
LIGHT PROOF WHEN CLOSED
INCLINED BOTTOM KEEPS PAPER FROM SLIDING FORWARD
PLYWOOD SIDES OVERLAP

PRINTING paper may be stored in this paper box for easy handling. One hand lifts the lid while the other withdraws the paper so that only one hand need be dry. Paper is protected from light by overlapping sides of the lid and black cloth over the hinged joint. Construction is of plywood and a wedged-shaped bottom so inclined that the paper will not slide forward under the edge of the lid.



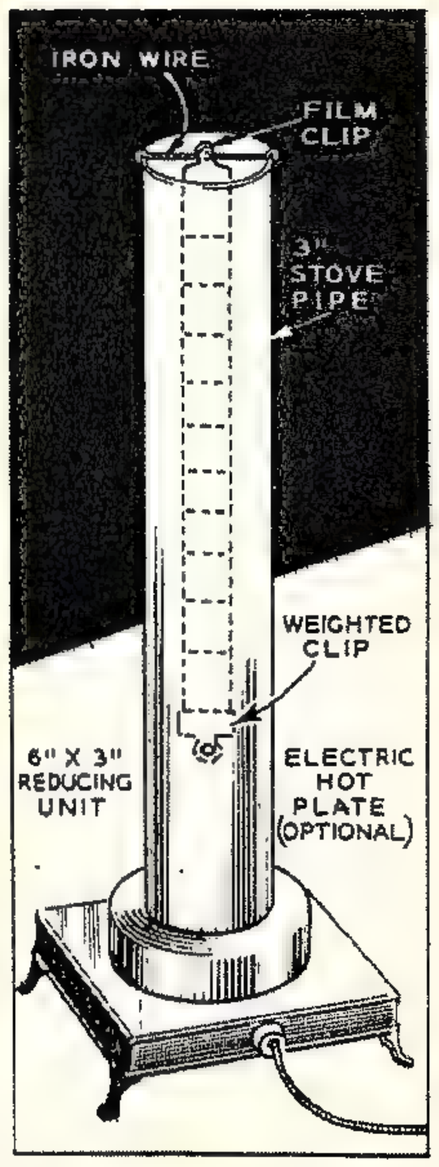
Two-Way Darkroom Light



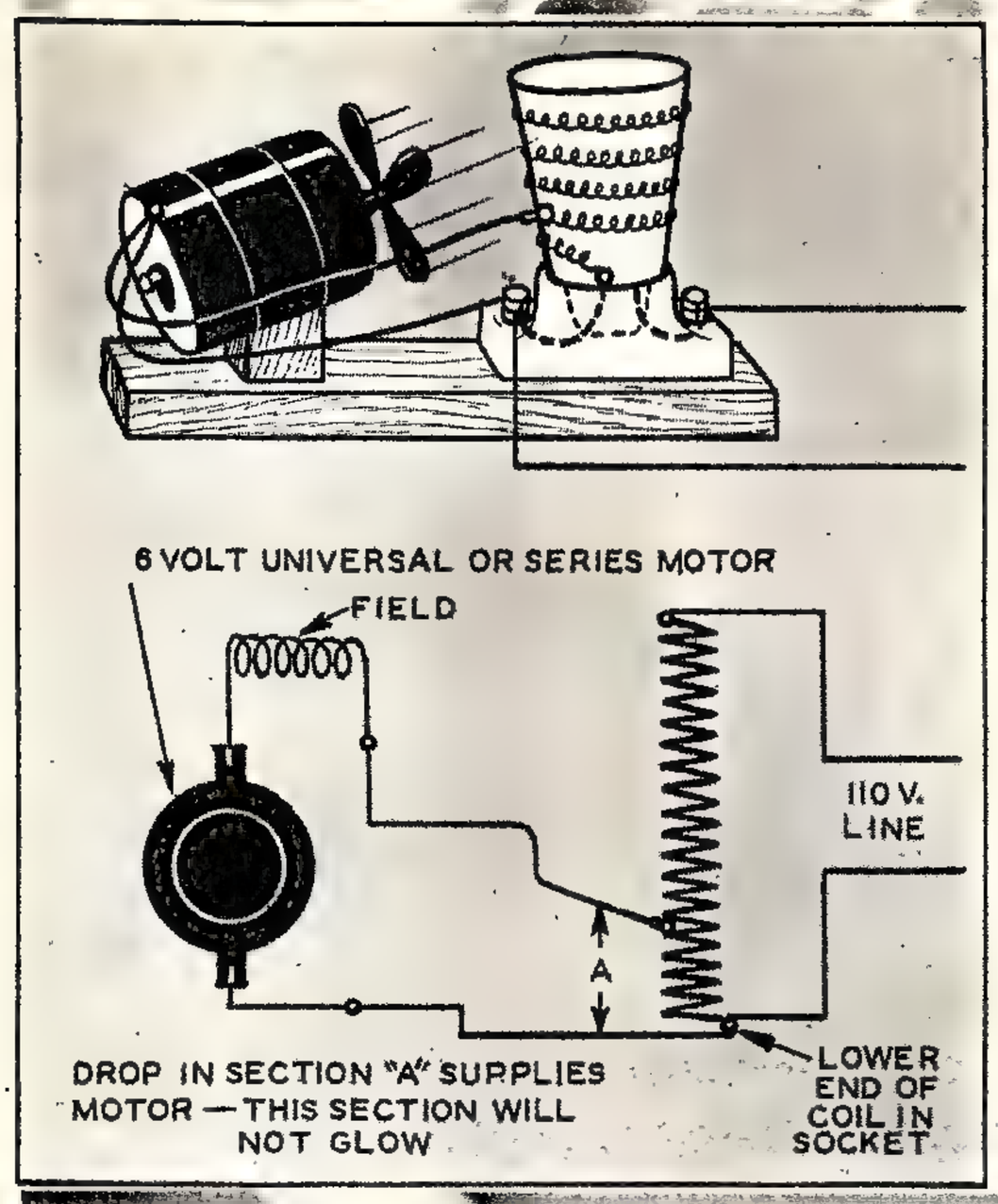
THIS two-way darkroom light has a sliding sash with a ruby pane which may be used for either white or ruby light in the darkroom while illuminating an outside room or hall with white light at the same time. The light is built in the partition of the darkroom. The sliding sash is on the inside. In this way wiring is simplified and expense is reduced. A flip of the finger changes from white to ruby light as easily as throwing a switch. A frosted glass outside gives effect of sunken wall lighting.

Roll Film Drier

ALL that is needed for this rapid roll film drier is a length of 3-inch pipe, a 6-inch to 3-inch reducing unit and a piece of wire from which the film is hung. The pipe is fitted over an electric hot plate and the film will dry in a few minutes. A hot plate with a heat control switch for low-heat is best.

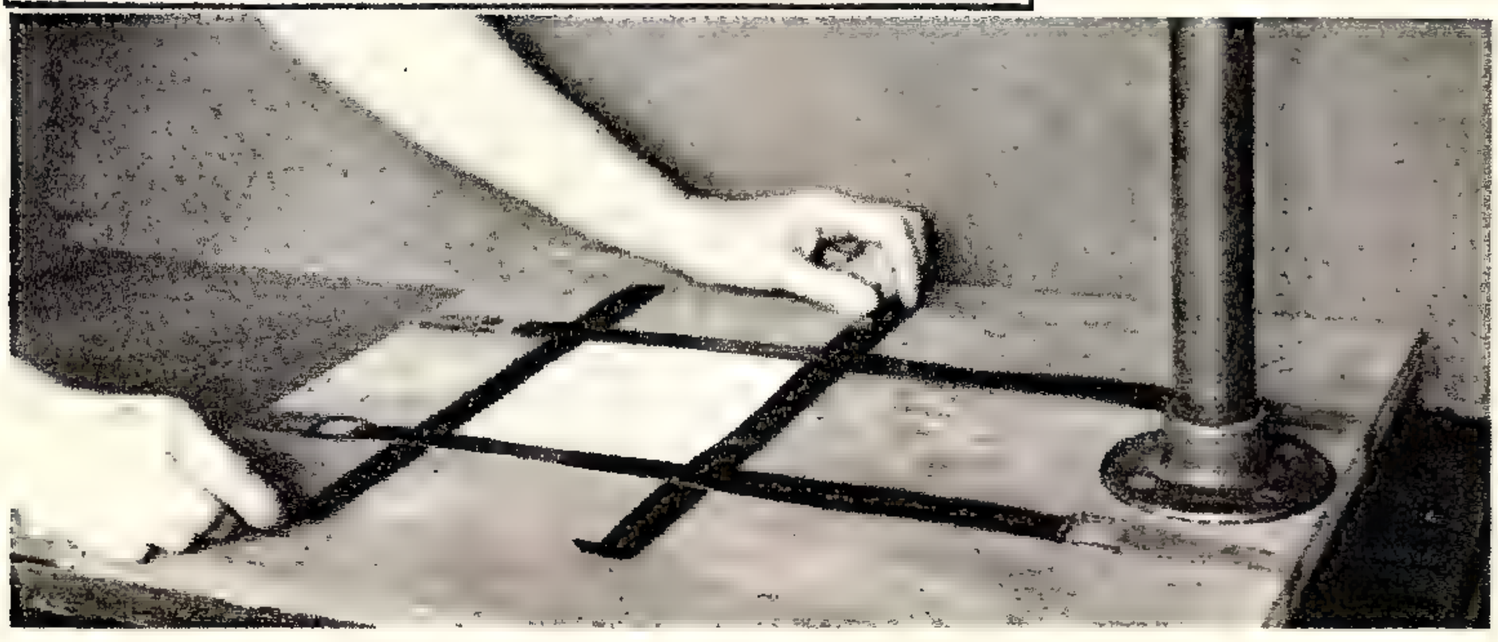


MOTOR Operated DRIER


6 VOLT UNIVERSAL OR SERIES MOTOR
FIELD
110 V. LINE
A
DROP IN SECTION "A" SUPPLIES MOTOR — THIS SECTION WILL NOT GLOW
LOWER END OF COIL IN SOCKET

A 6 or 8-volt motor is excellent for hot air drying. Simply connect motor leads across a portion of the heating coil. Mount motor on an inclined block fastened to a wood base. Mount socket for the heating coil in front of fan. Bring 110-volt leads to socket terminals and hook one motor lead to terminal contacting with the lower end of the coil. Move a small battery clip attached to the other motor lead away from the lower coil end until the desired motor speed is obtained. As the motor draws current from the shunted portion of the coil, this part will not glow. Motor and fan come from an auto hot water heater.

Adjustable Printing Mask

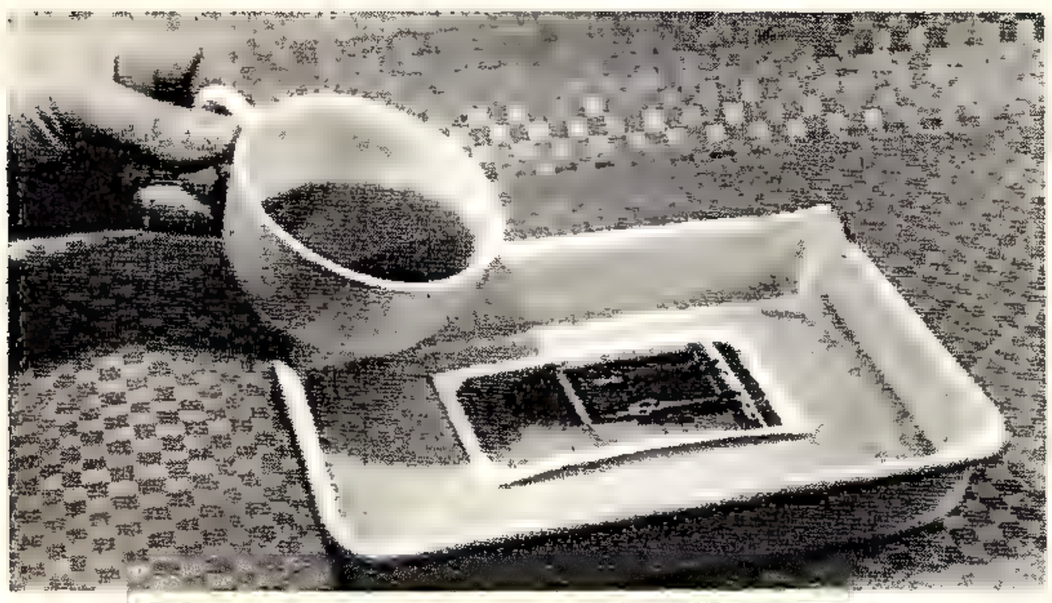


Cut 1-inch masking bands from ferrotype plate. Fasten to baseboard with strips of inner tube rubber. Loop ends of rubber strips and cement. Square loops from radio "bus bar" wire hold band and rubber strips together. Insert shorter bands under longer ones held by rubber strips. Bend up ends of shorter bands to facilitate inserting paper.

PHOTO

ATTACHING BOX CAMERA TO TRIPOD. When the lens aperture of a box camera is stopped down, and time exposures used, the results frequently are as good as can be obtained with a more expensive camera. The camera can be mounted securely to the tripod with a luggage or book strap.

FILTERING DEVELOPER QUICKLY. When time must be saved, solutions can be filtered quickly by using a nickel-wire strainer lined with a layer of cotton. If the strainer is not nickel plated, it should be coated thinly with asphalt varnish.



INEXPENSIVE TINTING SOLUTION. Ordinary black coffee is suitable for giving prints an even buff-to-sephia tint. The strength of the coffee can be determined by experiment.

SEALING DEVELOPER BOTTLES. A rubber cork of the expansion type, used for bottles of charged water, is a convenient and efficient cork for sealing bottles of developer.

KEEPING PRINTS FLAT. Glossy prints will remain flat if the backs are coated with "hair set" liquid after they are placed on tins. If the hair set is very thick it should be thinned slightly with water.

KINKS

AN EFFICIENT WASHING TANK. A tin waste basket can be converted into a practical washing tank for filmpack or cut film. Be sure to seal any leaks in the edge before attempting to use it.

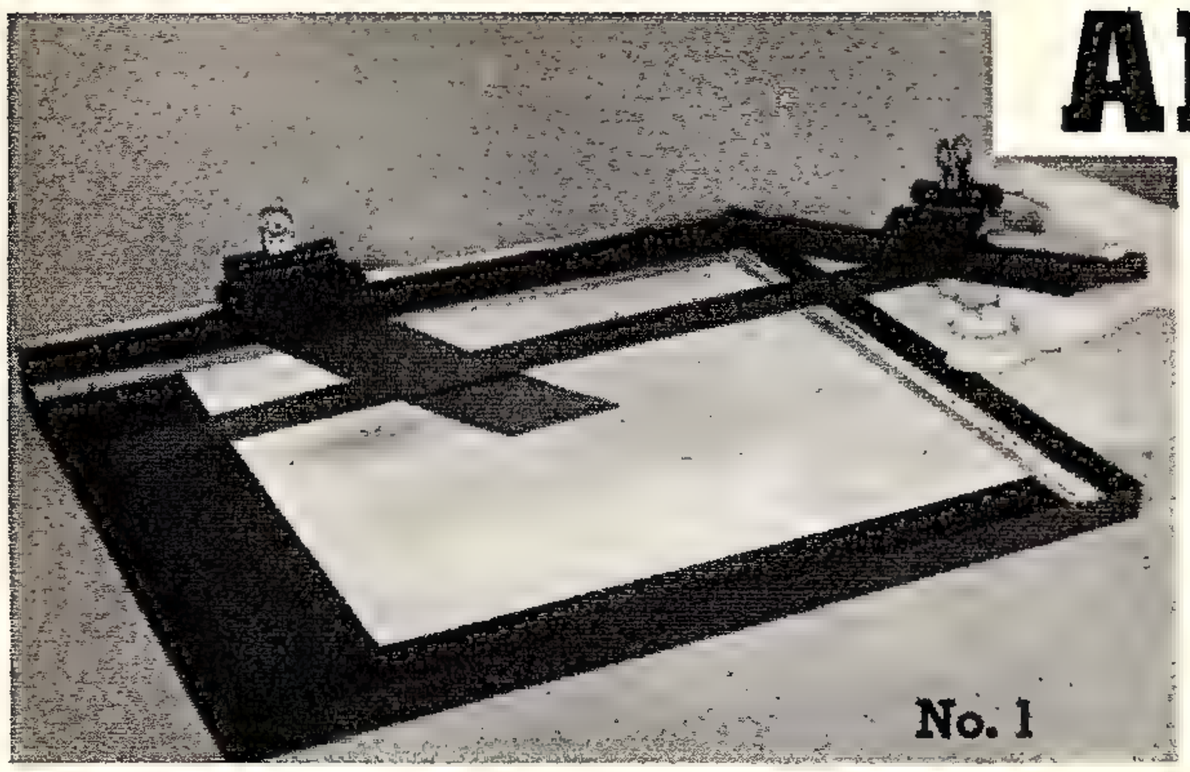
TRAY FOR DEVELOPING LARGE PRINTS. Prints of large size can be developed in a tray made of an old window pane with rabbeted pieces of wood attached to each side. The glass bottom and wood sides should be given two coats of asphalt varnish before use.

MOISTENED LIP OF TRAY AIDS POURING. When pouring from a pan or tray into a bottle, it is difficult at times to start the flow in the right direction. If the lip of the vessel is moistened, the fluid will follow the trail of moisture and not spill out at an unexpected point.

TRIMMING CURLED PRINTS. When photographs are not entirely flat, it is difficult to trim the edges evenly. To assure straight cuts, place a ruler over the edge of the print next to the trimmer blade to hold it in an even plane.

PREVENTING CURLING OF ROLL FILMS. Unless roll films are prevented from curling while in the hypo solution, portions may not become thoroughly fixed. Films will lie flat in a tank if the ends are fastened together with small clips as shown above.

ADJUSTABLE



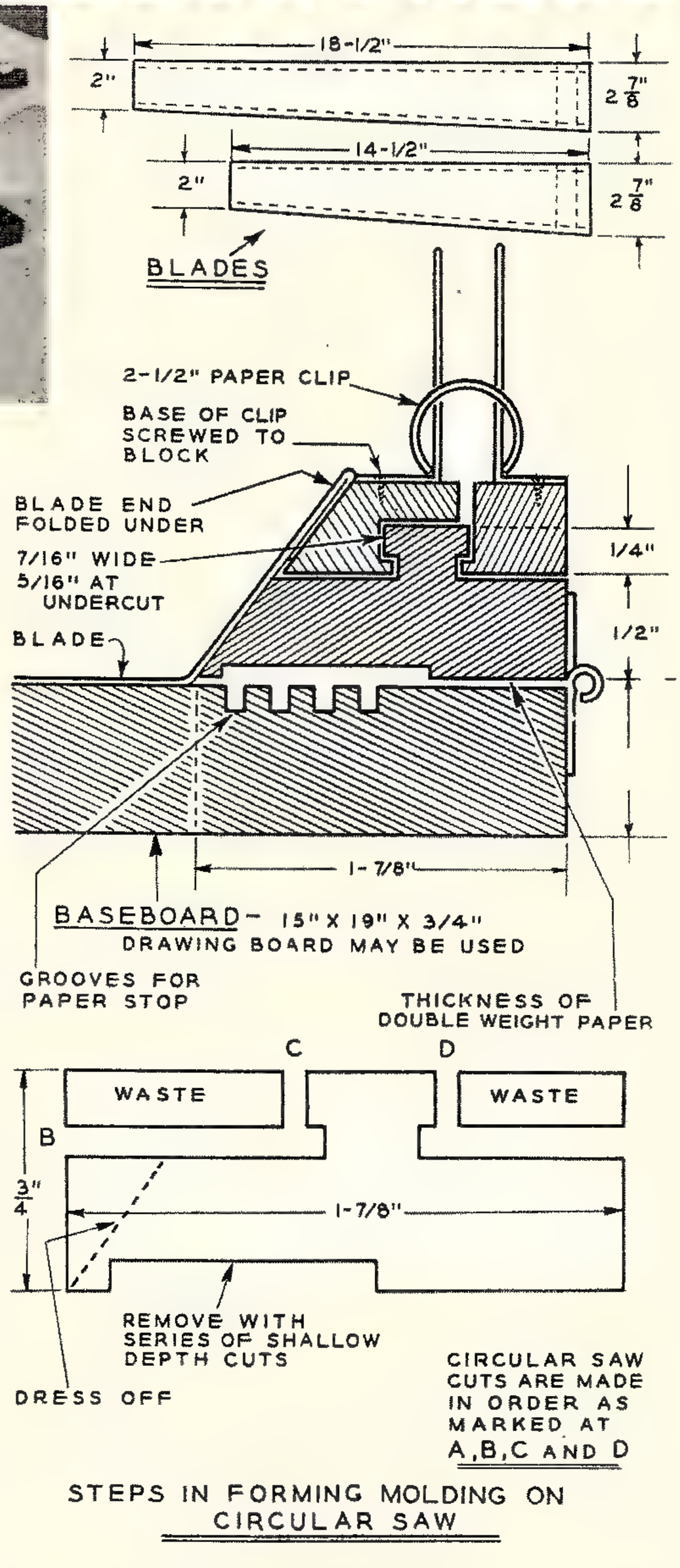
No. 1: The completed board. The piece of white paper is used to focus upon; it may be discarded when it becomes soiled.

PHOTOGRAPHIC papers used in enlarging are most unruly, when one tries to make them stay flat. The illustrated board, however, will hold them well, and, at the same time permit the making of prints with various sized, clean-cut white borders. The board shown here can easily be made by anyone having a small circular saw available, and at exceedingly small cost.

The baseboard should be made from well-seasoned material; a small drawing board, procurable at small cost, will serve this purpose excellently. Before starting to make the molding, which forms the try-square like hinged angle, give the circular saw blade a little extra set, if it is of thin gauge, till it will make a kerf $\frac{3}{32}$-inch wide. It will now do all the grooving required with but one cut to the groove. The method of making the molding is shown on the sketches at the right. Well-seasoned birch is preferable for this part, as it is tough, yet not too brittle. After roughing out the mold, dress it down with a rabbit plane (set very fine) and sandpaper. The slot tenon joint is also formed at the saw, while the track portion and bevel are hand mitered to fit. When glueing up see that the angle be held perfectly square on its inner margin.

The grooves for the paper stops are cut as shown on the saw, after the corner at which the angle is to be fitted is made square by setting the rip-fence and saw blade and then running side and end in turn over the saw, for each groove.

The paper clips will have to be taken apart, for drilling, bending and attaching to the small clamp blocks. When bending the two blade sections of the clips avoid too sharp a corner, as they are fairly brittle. If they do crack, they may be reinforced with solder. When the clamp blocks are attached, reassemble the clips and slide them on the molding track. The mask blades may now be secured (see photo 4). Fix the center screw and adjust with a square as shown before fixing the rest. These blades, if made from medium heavy sheet metal (about 26 gauge) need not have the edges turned under; rather have a tinsmith cut them to shape on his squaring shear. This will leave them with good straight edges that re-



STEPS IN FORMING MOLDING ON CIRCULAR SAW

ENLARGER EASEL

by Reginald O. Lissaman

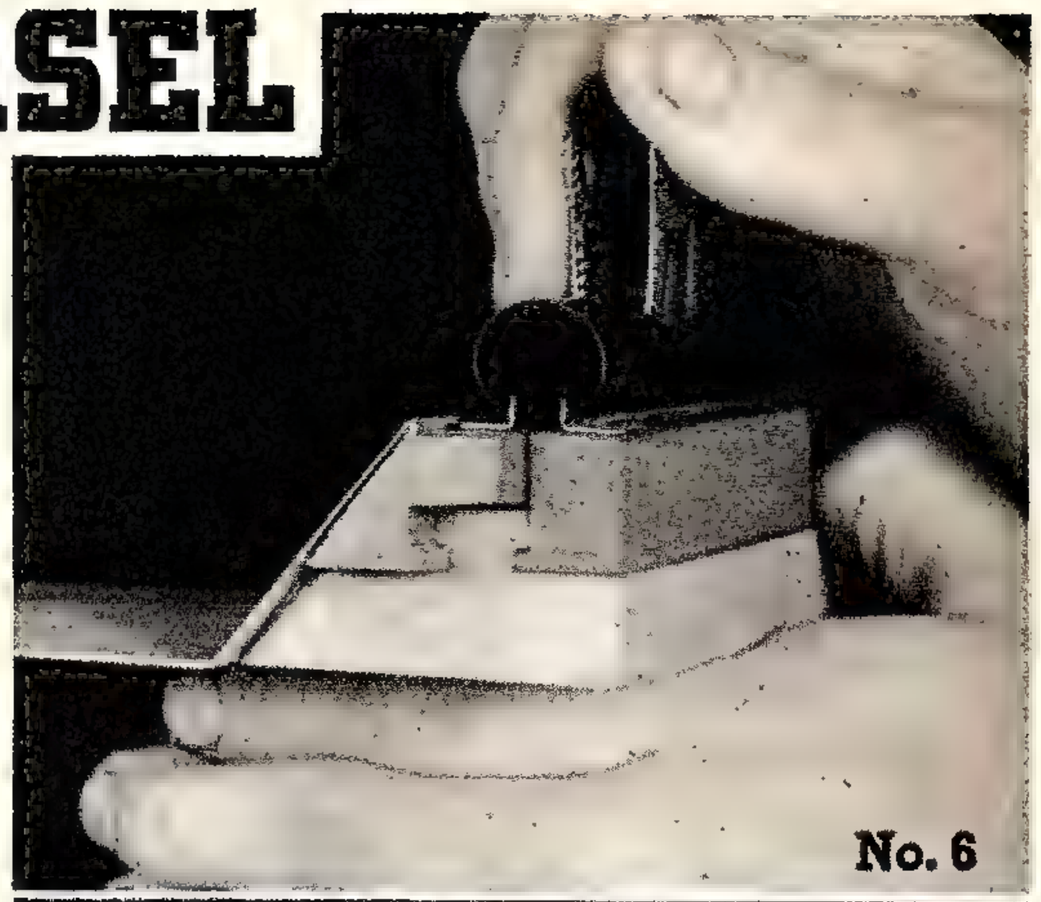
Holds paper flat during exposure and makes even white margins of adjustable size.

quire only smoothing down the sharp corners.

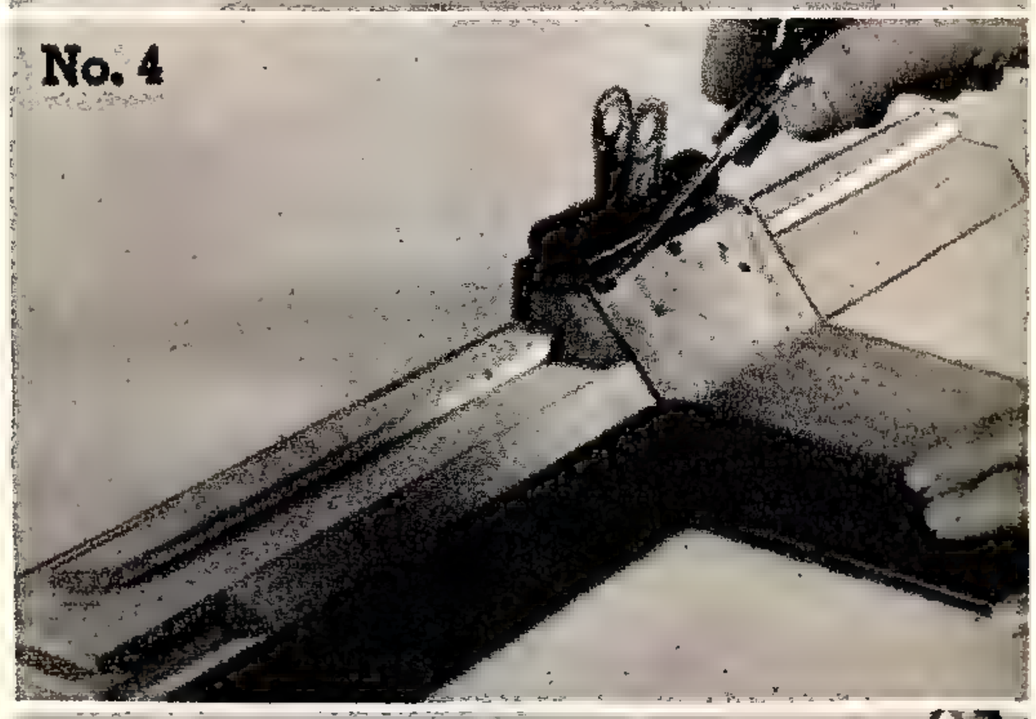
Fit small rippings, forming the paper stops, into the grooves in the baseboard so that they may be easily removed with the fingers. These strips, the grooves and the track section of the molding should not receive paint. One or two thin coats of shellac will prevent them soiling and at the same time avoid clogging them up with pigment. While the baseboard may be finished white for focusing, it is probably just as well to paint it mat-black along with the blades and mold, using a white paper for focusing; this may be discarded when it becomes soiled.

A little paraffin rubbed along the sliding portions when using the board will lessen any catchy friction that might be present the first time the easel is used.

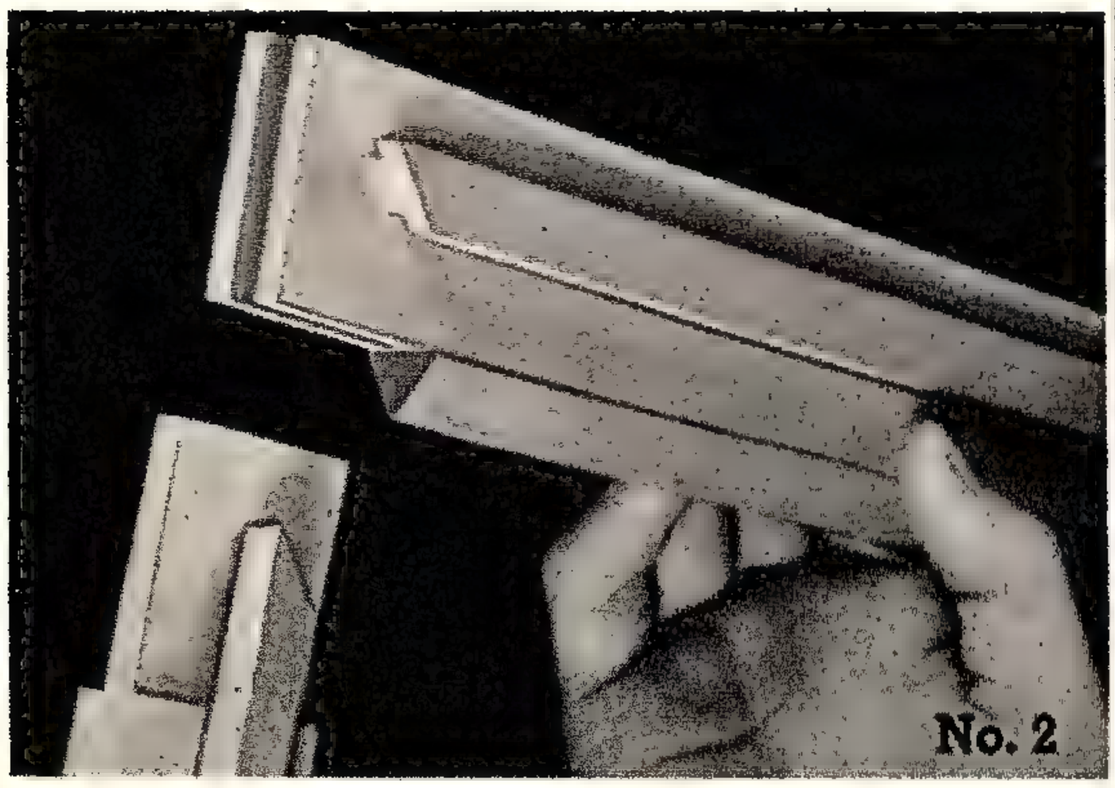
It is not necessary to clamp this easel to the enlarger base. Its own weight will keep it in place while exposures are being made. Small rubber "bumpers" on the under side will make good friction feet.

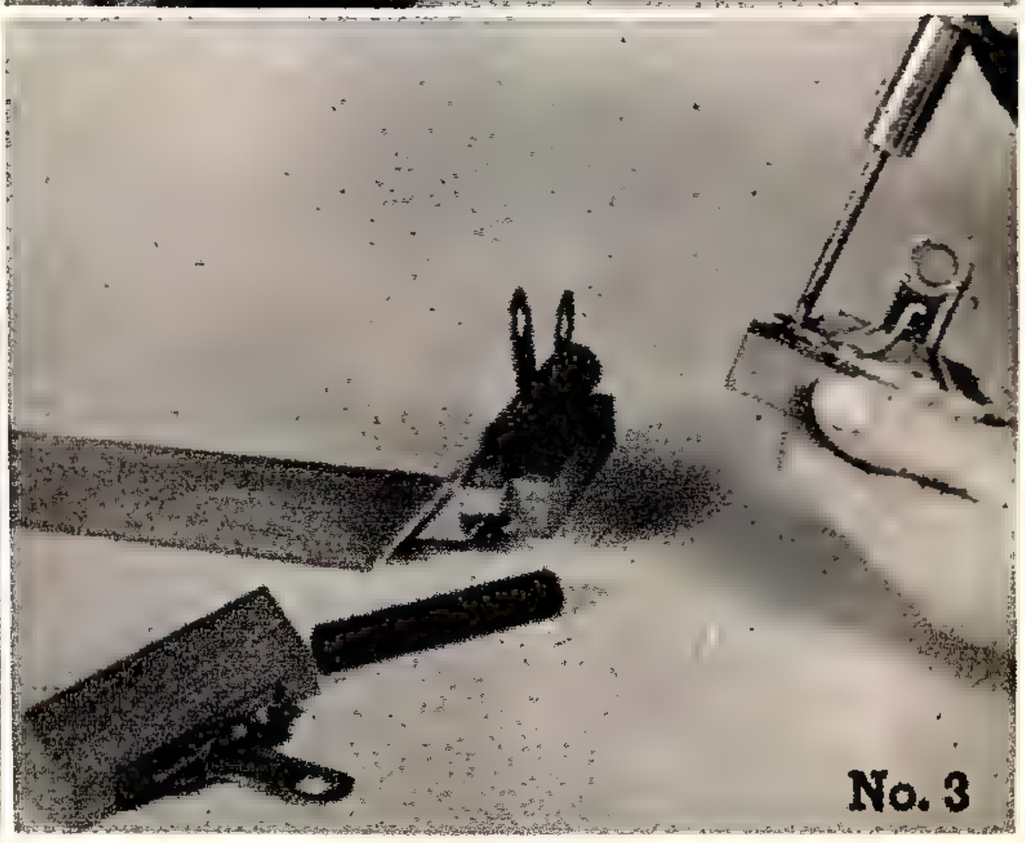

No. 6

No. 5


No. 4

No. 2: The molding with joint fitted; ready to be cleaned up. When assembling see that this portion is glued up square. No. 3: Showing how the clips are formed to make the clamps for the masking blades. No. 4: When attaching the blades to the clamp blocks do it in this mannet, keeping the masking blade at true right-angles to the moulding edge. No. 5: Showing how the paper stops fit into the grooves, thus providing for several widths of margins. No. 6: A close-up of the clamp and the molding. Note how the clamp-blocks fit around the track.

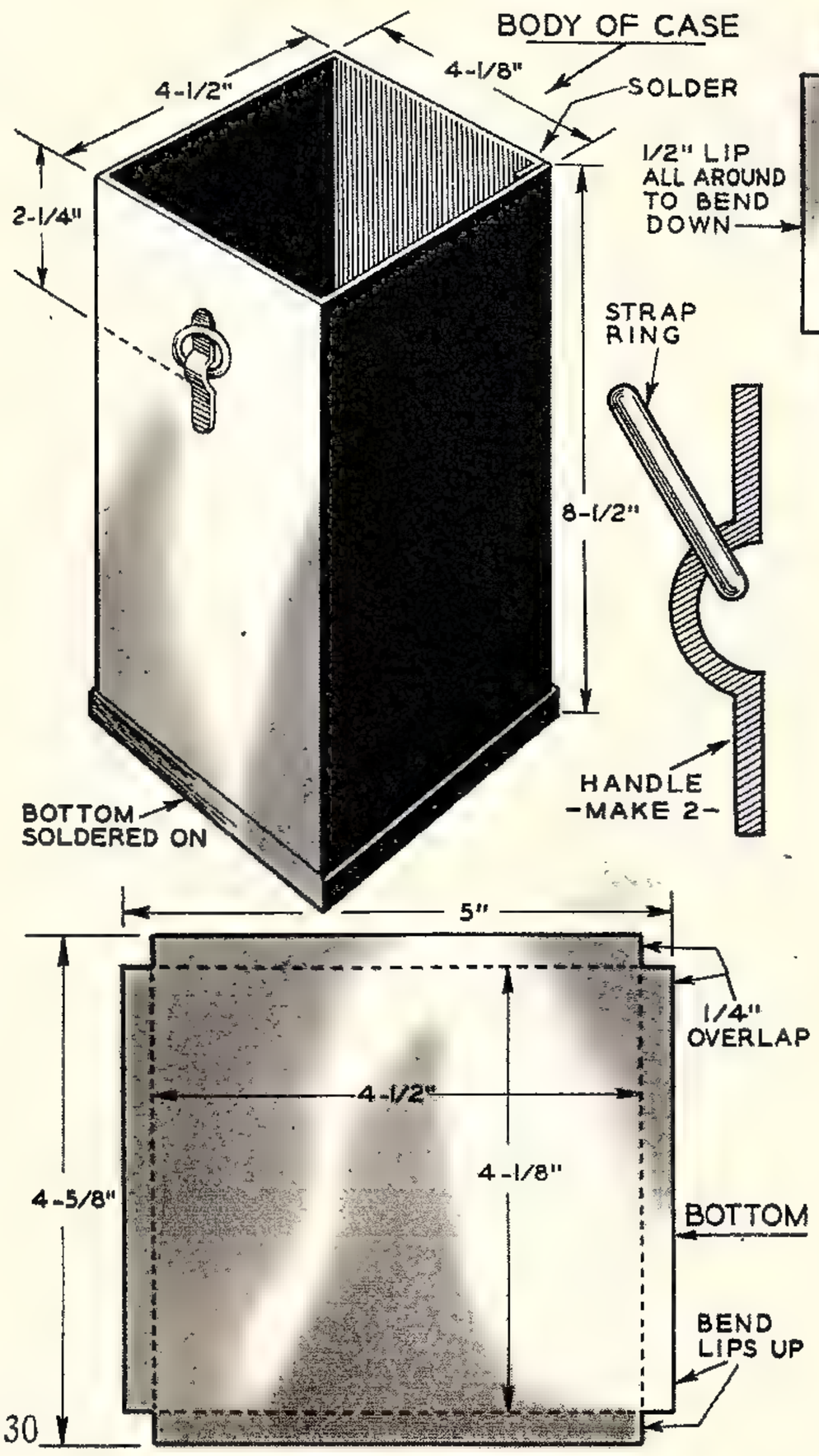

No. 2

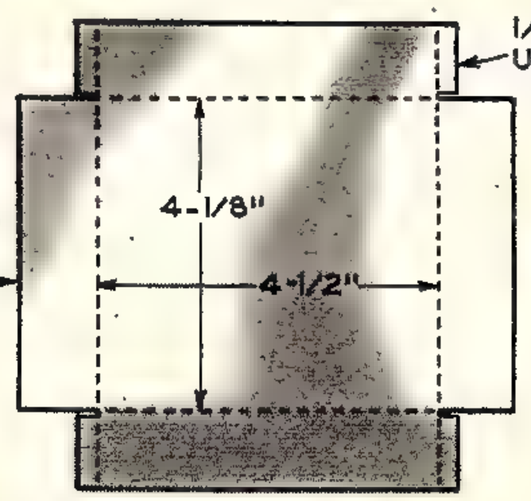

No. 3

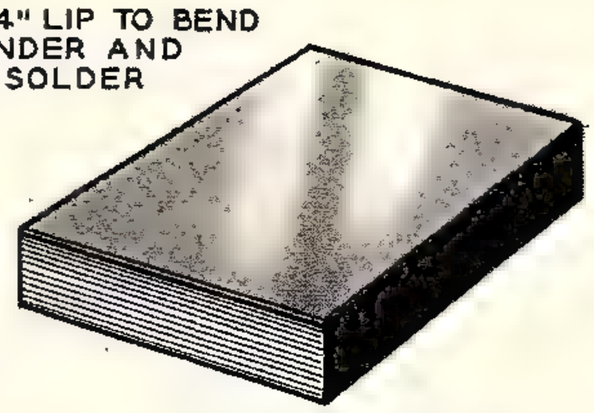
WATERPROOF CAMERA CASE

Above—Camera, film, light meter and filters all fit snugly into this metal carrying case built to withstand hard usage. Below—Showing construction details of the case. Strap handles are about ⅜x1", and are soldered in place.

The case may be suspended from the shoulder or carried by hand when using an adjustable strap.







FINISHED COVER

THE simple but rugged camera case shown on this page was designed by Dr. R. A. Clinchy of New York to withstand the rigors of hunting and fishing trips in many parts of the country.

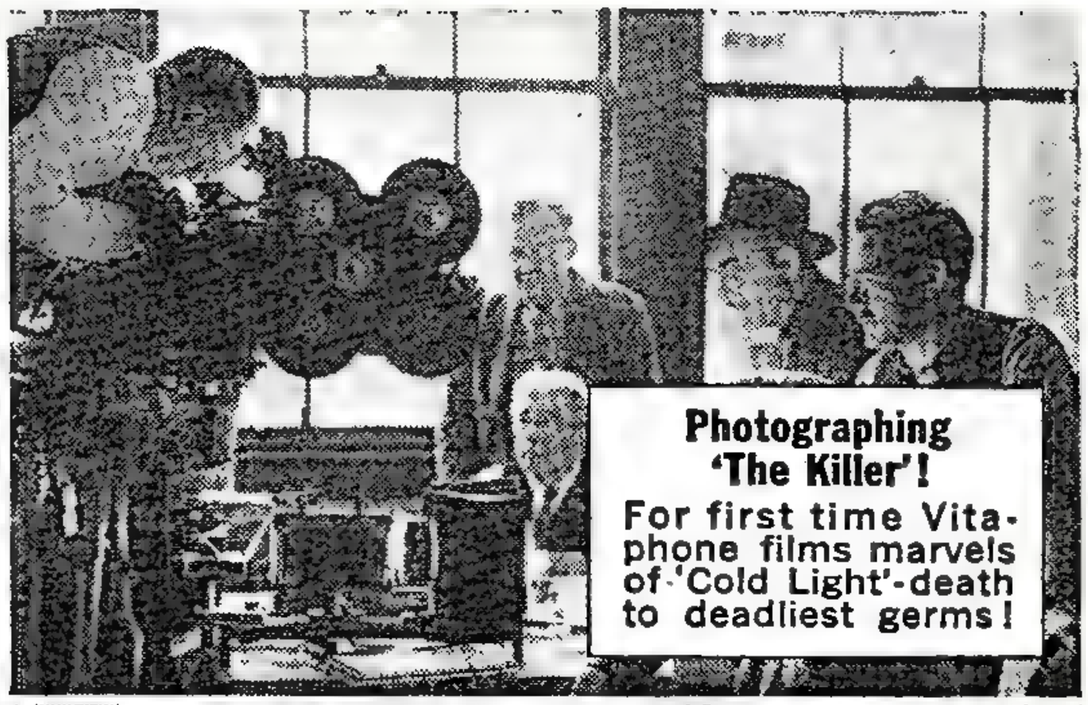
Made of stainless steel about $\frac{1}{16}$-inch thick, the case holds a 2¼x2¼-inch Reflex camera in its own leather case, a photo-electric exposure meter, sunshade, three filters and six spare rolls of film. The cover, which fits snugly, is held tightly in place by a loop of the web strap, passed over it and through strap rings on either side. A gasket of soft rubber, cut from weather stripping or an old inner tube, is cemented inside the cover.

The dimensions indicated are for Dr. Clinchy's own case, and are readily changed to accommodate folding type cameras. Brass is probably preferable to stainless steel because it is more generally obtainable in small quantities; also, it solders more easily.

Mechanix Illustrated—August, 1938

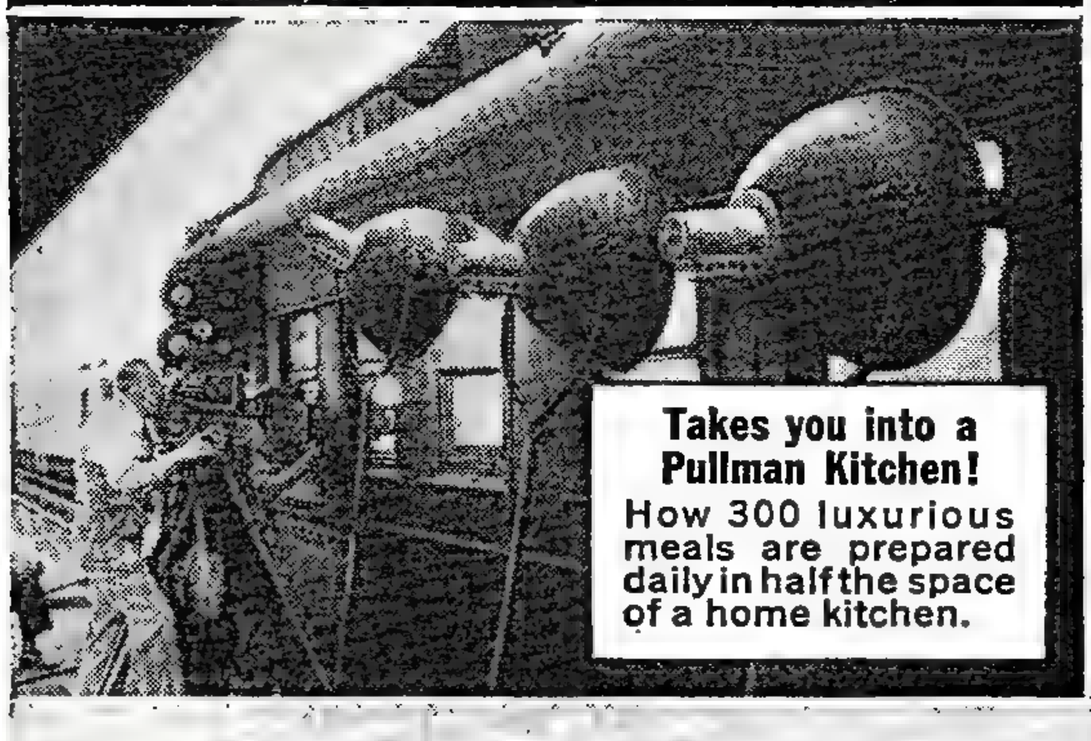
Modern Wonders of Science

Now on Your Favorite Screen!

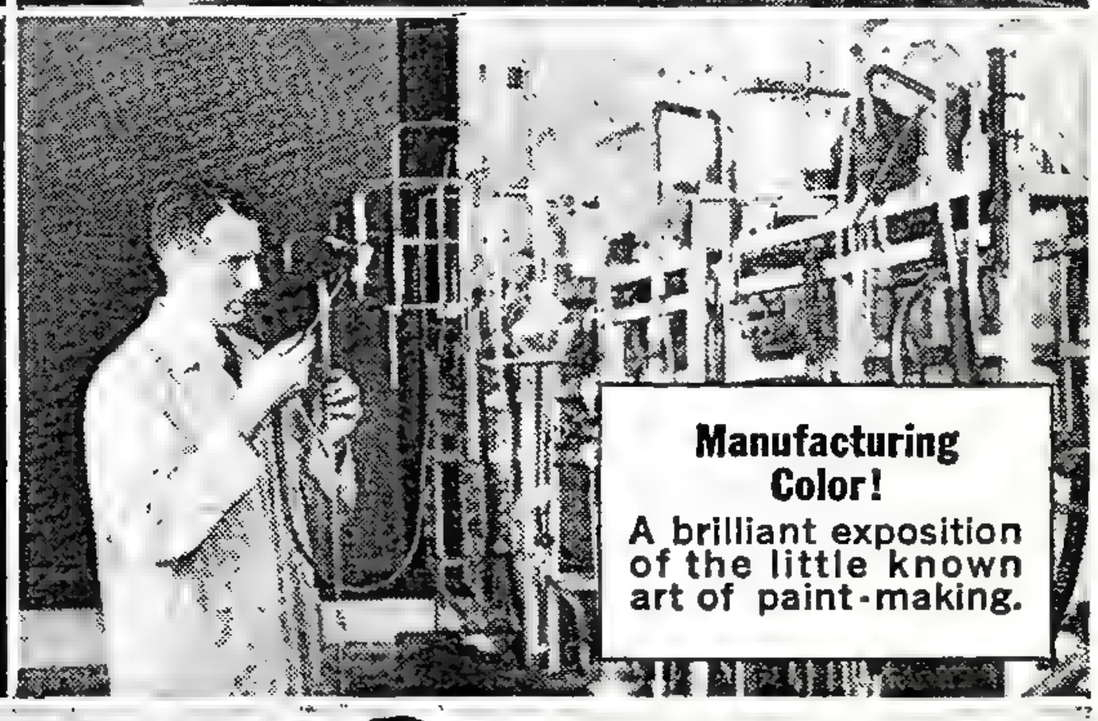


Photographing 'The Killer'!
For first time Vitaphone films marvels of 'Cold Light'-death to deadliest germs!

The Mystery of 'Frozen Foods'!
Has science conquered the famine problem? You'll see!



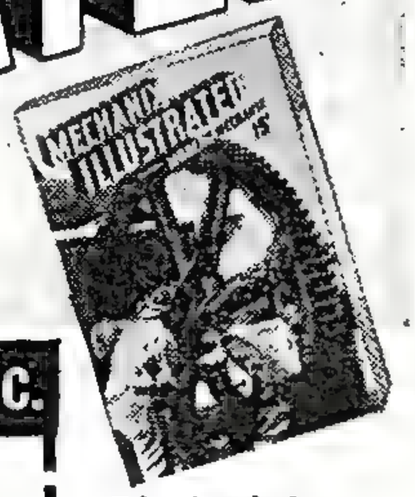
Takes you into a Pullman Kitchen!
How 300 luxurious meals are prepared daily in half the space of a home kitchen.



Manufacturing Color!
A brilliant exposition of the little known art of paint-making.

All Shown in the First Issue of Warner Bros.' Sensational New Vitaphone Shorts **In Natural Color**

MECHANIX ILLUSTRATED



Filmed with the co-operation of famous MECHANIX ILLUSTRATED Magazine

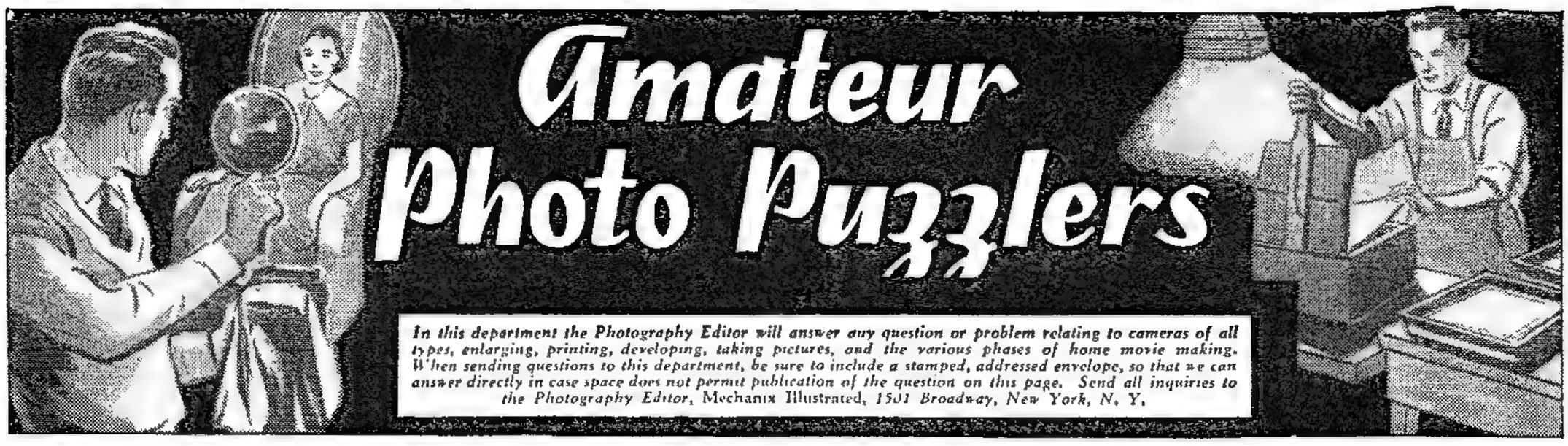
Send this convenient coupon today to: Vitaphone Shorts, 321 W. 44 St., N.Y.C.

I am anxious to know when the .....theatre will show the first of the new series of Vitaphone Shorts, "Mechanix Illustrated".

Name.....

Address.....

City .....*State*.....


Amateur
Photo Puzzlers
In this department the Photography Editor will answer any question or problem relating to cameras of all types, enlarging, printing, developing, taking pictures, and the various phases of home movie making. When sending questions to this department, be sure to include a stamped, addressed envelope, so that we can answer directly in case space does not permit publication of the question on this page. Send all inquiries to the Photography Editor, Mechanix Illustrated, 1501 Broadway, New York, N. Y.

SUN SHADES

What is the advantage of using a sun shade on a camera lens?—C. W. Powers, St. Louis, Mo.

A sun shade prevents sun from being reflected directly into the camera when its rays strike the polished surfaces of the lens barrel or are apt to be reflected into the lens from some external source. More brilliant negatives are the result when sun shades are used. Anything with a dull black surface that fits over the lens, funnel-like, may be used, but its length should not protrude into the field of the lens.

NON-STAINING DEVELOPER

What is a good formula for a non-staining developer?—Carl D. Damberg, Schenectady, N. Y.

Almost all modern developers are non-staining. These use the elon-hydroquinone developing agents, whereas the old type staining developers are of the pyro type. A conventional, standard non-staining developer is D-76, universally used for fine grain work by professional photographers. D-76 may be prepared from the following formula:

Water (about 125° F.)	24 oz.
Elon (metol, pictol, etc.)	29 grains
Sodium sulphite	3 oz. 145 grains
Hydroquinone	73 grains
Borax	29 grains
Cold water to make	32 oz.

Dissolve in order named. Use without dilution. Develop panchromatic roll or cut film 16 minutes at 65° F. in tray or 20 minutes in a tank of fresh developer.

LENS FILTERS

Please tell me about the different kinds of filters available and what each is used for?—Stephen De Orlo, Youngstown, Ohio.

Conventional filters available for use by both professional and amateur photographers are yellow, red and green. These filters are used for reproducing colors in monochrome in any desired degree. They may be used to create light or dark cloud effects. Red filters create dark skies and bring out clouds more strongly than the yellow filters. Green filters "break" up the color of green foliage and produce a contrasty picture in a field where green predominates. Filters consist of colored optical glass or of specially prepared gelatin in which has been incorporated an organic dye. Those most commonly used are the No. 1 light yellow for short exposures; No. 2, a stronger yellow for use with regular panchromatic film; pale green filter for use with regular panchromatic; dark green for super-pan films; No. 3 yellow for photographing dark objects; orange red for striking cloud effects, mountains, etc.; dark red for deeper sky effects, dark woods, haze, etc.

PICTURES OF MOVIES

Will you please tell me if pictures of movies can be taken in theatres with a camera using an f.2 lens?—Don Ortner, Frankenmuth, Mich.

An f.2 lens has considerable speed and if used in conjunction with a high speed panchromatic film, satisfactory pictures can be made directly from a movie screen, provided, of course, the action on the screen is not too fast. Use the lens wide open with a shutter speed of about 1/30 second to stop close-ups, etc.

OPAL OR GROUND GLASS

What effect would I get by substituting ground glass for opal glass in my enlarger?—George M. White, Hallowell, Me.

If you substitute ground glass for opal glass, you would get a stronger light, thus reducing the length of time for exposures. Although opal glass reduces the intensity of light, it gives even, soft lighting.

CANDID CAMERA

I am thinking of buying a candid camera. Will you please give me some information regarding them?—J. Lubanski, Norwich, Conn.

The use of the term "candid camera" is misleading. "Candid" applies to a method of photography rather than to a type of camera. Any camera with a fast lens that can be manipulated quickly may be used for candid photography. An article entitled "When Is a Camera Candid?" appears in the book "Good Photography," available on newsstands. This article gives a simple and interesting explanation of "candid photography."

EXPOSURE METERS

Can exposure meters of the photo-electric cell type be used to accurately measure the amount of light indoors from light to dark interiors? Do they provide film speed settings for the faster films?—Willard F. Werth, Dayton, Ohio.

All exposure meters of the photo-electric cell type as well as of other design may be used to measure intensity of light from light to dark in interiors. Some meters are especially designed to take compensating readings for very dark interiors. Such meters also give the light range from light to dark. Depending on the method of calibration, some meters are more sensitive in dark interiors than others, but basically, all meters are designed for use indoors as well as outdoors.

CHANGING FILM SAFELY

I took my camera to the beach recently where it was necessary to load and unload it several times in changing film. When that film was developed, I noticed that it was fogged in places. What caused this?—J. Bailey, Seattle, Wash.

Fogged film in this instance was probably the result of changing rolls in direct sunlight. Even daylight loading film spools are not really fool-proof against being light-struck or fogged if handled in direct sunlight, and for that reason, film should be changed in a shaded, if not dark place. When changing film at the beach or similar place where the sun is strong and is reflected by sand or other objects, it is best to turn the back to the sun and watch out for reflected sunlight.

MIXING HYPO

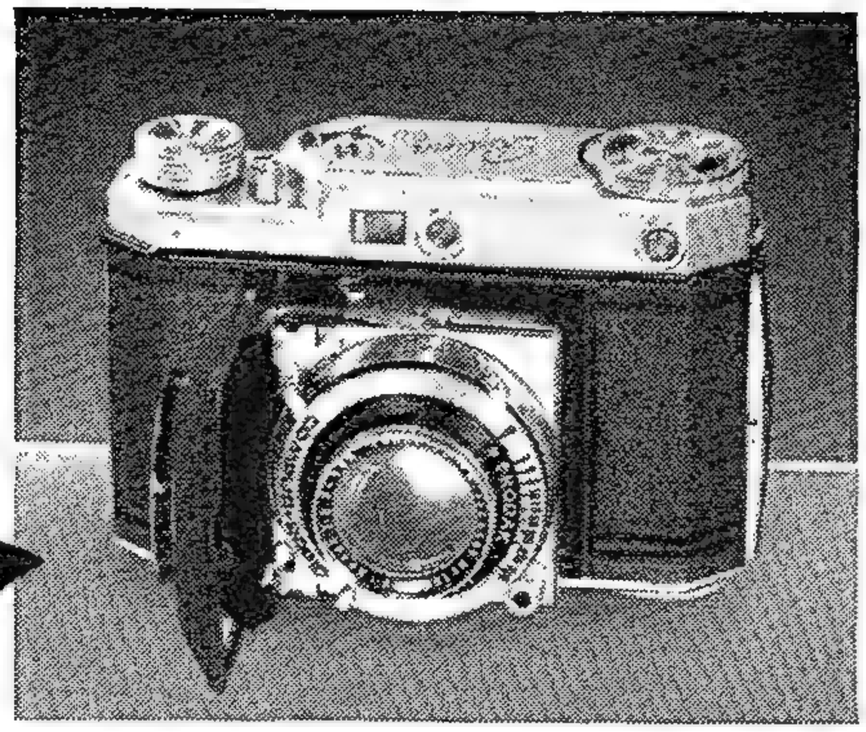
I recently mixed some hypo in hot water and a crystal substance formed. Can you tell me what happened?—M. H. Stinton, New Orleans, La.

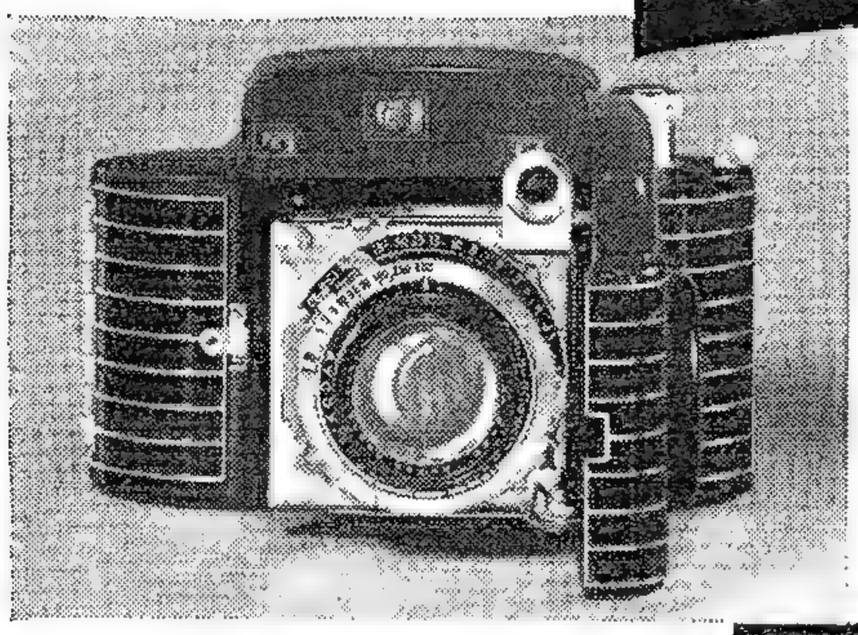
Hypo should be mixed in hot water at a temperature of 125° F. A temperature in excess of this causes excessive oxidation with precipitation of hypo salts as a result. High temperatures simply hasten the absorption of oxygen. Hypo may be mixed in water at any temperature between 65° and 125° without difficulty. The salts dissolve more easily at the higher temperatures, however.

MECHANIX ILLUSTRATED AWARDS $40 EACH MONTH FOR BEST PHOTOS SUBMITTED BY READERS

The editors of MECHANIX ILLUSTRATED distribute $40 in cash awards each month to the five persons who, in their opinion, submit the best pictures suitable for publication in the MECHANIX ILLUSTRATED Photography section. Full particulars regarding these awards will be found in this issue on page 119.

Eastman's "Miniature" Family





KODAK RETINA II (*above*) . . . Lens, anastigmat *f*.2.8 or anastigmat *f*.2.0. Shutter, 1/500 Compur-Rapid. Coupled coincidence-type range finder. Body shutter release. Double-exposure prevention device. Kodak Retina II, *f*.2.8, $115; Kodak Retina II, *f*.2.0, $140. Prices include sportsman's field case.

KODAK RETINA I (*not illustrated*) . . . Lens, Kodak Anastigmat EKTAR *f*.3.5. Shutter, 1/500 Compur-Rapid. Film-measuring mechanism. Exposure counter. Depth-of-focus scale. Price, $57.50.

KODAK BANTAM SPECIAL (*above*) . . . Lens, Kodak Anastigmat EKTAR *f*.2.0, extra-fast, super-corrected. Shutter, Compur-Rapid, 9 speeds to 1/500 second. Built-in coupled range finder of the split-field military type finds the range and focuses in one operation. Film-centering device locks film accurately in position for each exposure. New low price, $87.50, includes field case.

KODAK DUO SIX-20, Series II (*left*) . . . The miniature that takes album-size pictures (1⅝" x 2¼"). Lens, Kodak Anastigmat *f*.3.5. Shutter, 1/500-second Compur-Rapid. Eye-level finder frames action—makes it easy to follow. Body shutter release minimizes danger of camera movement. Bracket for Kodak Pocket Range Finder. Price, $57.50.

Only EASTMAN makes the KODAK

LOAD WITH A WIDE RANGE OF BLACK-AND-WHITE FILM . . . Kodak Retina I and Kodak Retina II load with Kodak "SS," Panatomic, Super X, and Infra-Red Film; Kodak Bantam Special, with Kodak Panatomic and Super X; Kodak Duo Six-20, Series II, with Kodak Verichrome, "SS," and Panatomic.

ALSO LOAD WITH KODACHROME (FULL-COLOR) FILM . . . Kodak Retina I, Kodak Retina II, and Kodak Bantam Special also load with Kodachrome Film for gorgeous full-color transparencies. These may be viewed as they are, or mounted in slides for large-size projection with Kodaslide Projector. At your dealer's . . . Eastman Kodak Company, Rochester, N.Y.

KODASLIDE PROJECTOR . . . Ideal for projecting mounted Kodachrome transparencies. Built to precision standards. Yields big images of unsurpassed over-all clarity. With 8-footcord, switch, plug, 4⅞-inch lens, $48.50.

Build This Simplified Kayak

[*Continued from page 99*]

Casein waterproof glue should be applied at all joints to strengthen the structure. Install the chine battens in the same manner, and then the deck battens. Now the frame can be lifted off the plank and turned upside down to receive the bottom battens. If the plank is not a heavy one, leave it attached to the keelson when turning the frame over, as it will prevent warping until the bottom battens are screwed down.

Turn the kayak right side up again and fit the mahogany coaming. Use brass screws and casein glue, as in the other joints. The high ends of the coaming serve as splash boards, thus eliminating the need of the conventional Vee-type. An oval cockpit may add much to the appearance of your craft, but it also adds construction problems, hence the rectangular cockpit is recommended for the amateur.

Now turn the frame upside down again and lay a sheet of 10-ounce duck over it, tacking a few points along the keelson to hold it in place. Next draw a side toward the sheer batten and tack temporarily, pulling it as snugly as possible. Do the same on the other side, and lap the ends over the edge of the stem pieces. This is done, of course, before the curved member, or cutwater, is screwed on. Apply marine glue under and over the lap of the canvas. Trim away the overlapping canvas only after you are satisfied it fits over the frame smoothly, then copper-tack all along the sheer, staggering the tacks about one inch apart. *Do not tack along the chine.*

The next step is to apply airplane fabric dope to the canvas, which should bring it just about as taut as a drum-head when dry. This is done after the deck canvas is laid, so that the entire job can be done in one operation.

As soon as the dope is thoroughly dry the canvas can be painted. The ultimate smoothness of the surface depends upon how many times it is painted with a thorough sandpapering in between. A coat of spar varnish is applied last.

Rub-rail and keel, as well as moulding around coaming, are installed last. Also the curved cutwater pieces at each end and the brass strip over them.

A satisfactory paddle can be made as shown in the drawing, jointed in the middle with the blades set at right angles, an easy arrangement for continuous work.

Where beaches are rough, it will be a good plan to add a hardwood rub-rail along the chine, to protect it from the inevitable grinding at this edge.

For a featherweight craft, all the frames can be reduced to ⅜ by ⅞-inch section, and white pine used instead; the stems made of smaller section than in this design and yellow pine used where oak is specified. The battens can be ¾-inch wide instead of 1-inch, and silk or muslin used for the skin. Of course such a light-weight craft demands expert care and operation.

The Twin Triode Regenoflex

[*Continued from page 97*]

Blank coil forms are obtainable; the winding data are shown in Fig. 4. Broadcast coils can be built, provided the constructor is adept at multilayer winding. If broadcast coils are desired and are too tricky to wind, they can be purchased. However, be sure to remove the tickler winding from any purchased coil.

After wiring and checking the circuit, connect the receiver and tune in a signal. Manipulate the regeneration control until you get the "feel" of its action. It may be noticed that a slight squeal accompanies the break into oscillation. This squeal disappears when the control is backed down again. Sensitivity is highest when the control is so set that the receiver is between the non-oscillating and squealing state.

Some advantage is to be gained by making R3 a rheostat instead of a fixed resistor. When R3 is a rheostat, it can be set low without squeal and a station tuned in. It can then be increased for maximum volume. When R3 is a rheostat, its value should be 25,000 ohms; a potentiometer using only two terminals is perfectly all right.

The r. f. choke L2 is used to keep r. f. out of the phones. It is simple to make and its value is not critical. Merely wind 50 turns of No. 26 or No. 28 S. C. C. wire on a ¼" dowel, as shown in Fig. 5. If, with your arrangement of parts, you still get r. f. in the phones, increase the size of the coil to 100 turns. It is easy to know when you get r. f. in the phones: you can tune out a station by merely gripping the phone cord.

Be sure to use a good ground and a good aerial. Tests with this receiver show that with a 30-foot aerial and a radiator ground, many foreign stations can be tuned in. In a single evening, six South American stations and two English stations were received (in New York).

LIST OF PARTS:

T1, T2—One type 6F8G tube
T3—One type 80 tube
C—140 mmf. tuning condenser
C1—25 mmf. mica condenser
C2—0.01 mf. mica condenser
C3—0.1 mf. paper condenser
C4—0.0005 mf. mica condenser
C5—0.00025 mf. mica condenser
C6—0.01 mf. mica condenser
C7—0.0005 mf. mica condenser
C8—0.00025 mf. mica condenser
C9—16 mf., 150 volt electrolytic
C10—16 mf., 150 volt electrolytic
One octal-base socket; two 4-prong sockets
L—See Fig. 4
L1—30-henry choke coil (standard receiving type)
L2—See Fig. 5
P. T.—One 200-volt power transformer, with 5- and 6.3-volt filament windings
R1—1 megohm, ½ watt resistor
R2—300-ohm potentiometer
R3—10,000-ohm resistor or 25,000-ohm potentiometer (see text)
R4—350-ohm resistor
R5—25,000-ohm, 2-watt resistor
Dial, knobs, hardware, etc.

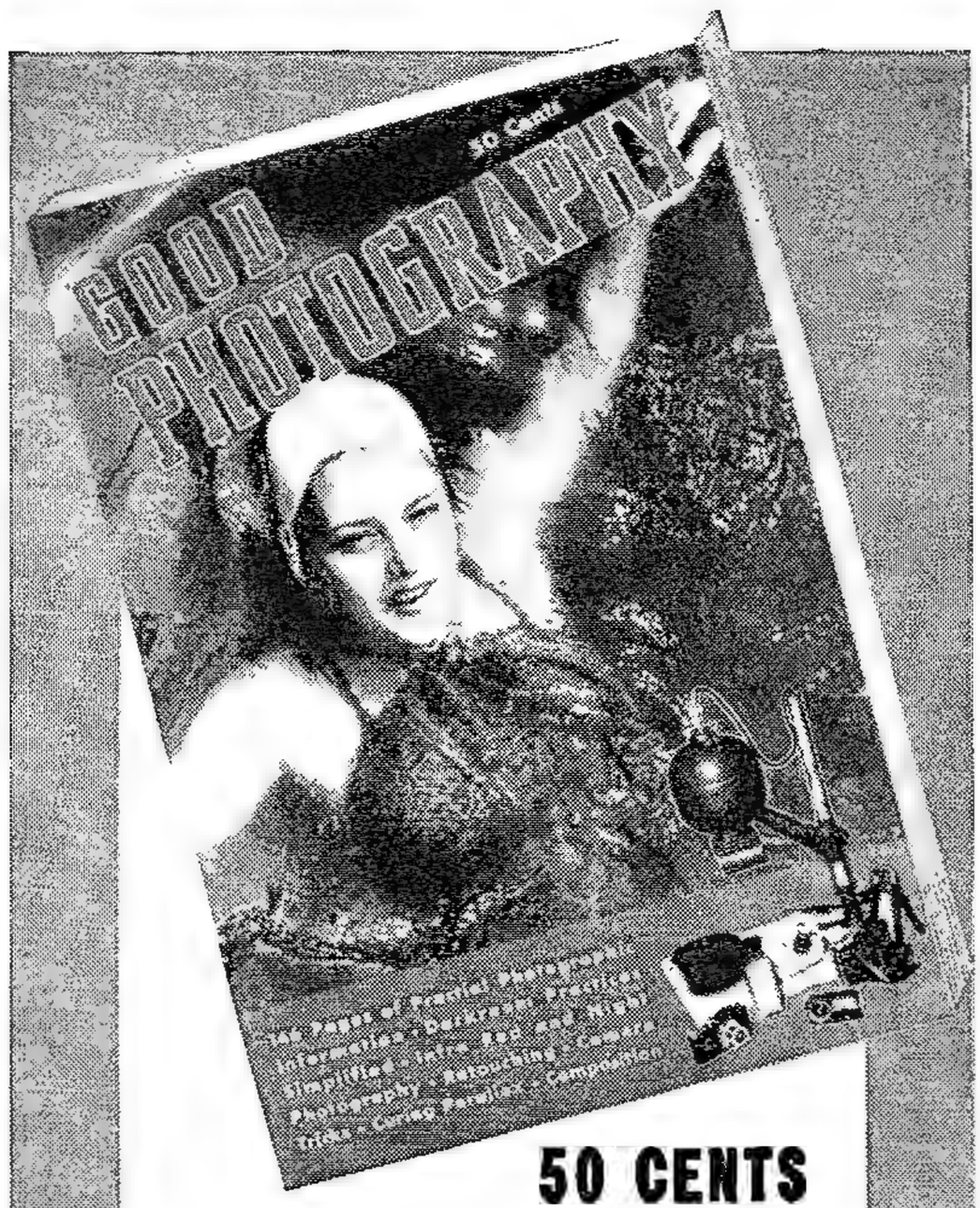
Secrets Of Circus Engineers

[*Continued from page* 39]

were seated on it, basking in the sun and smoking cigarettes, "What do you guys think that is—a SMOKE wagon?"

The circus builds its own wagons and cages at winter quarters in Sarasota, Florida, where the winter months are spent in rejuvenating all physical equipment and in the construction of new equipment. Principal builder is Bill Yeske, who has lost count of the number of wagons he has built for the big show. Recently he built the largest cage ever constructed. It was for Gargantua, the huge gorilla that is the circus' animal feature this season. The cage is twenty-six feet long, about the width of a railroad car and it weighs about 9 tons. It has shatter-proof glass outside enameled steel bars and it is air-conditioned to protect the savage primate against cold and pneumonia germs to which all his kind are susceptible. In recent years, many cage bodies have been built from aluminum in an effort to reduce weight and many of the wheels of the heaviest circus wagons are rubber-tired to prevent the destruction of asphalt streets in the cities along the line of march.

The big show on the lot resembles nothing so much as a canvas city with its blacksmith shop, barber-shop and beauty parlor, doctor's tent, post office, restaurants, legal department, zoo and its enormous auditorium or big top. Its people and its animal citizenry are recruited from all over the world and it is nomadic after the fashion of the flying carpet. Its rumbling red wagons have rolled to the persistent beat in the hearts of courageous men and women whose first loyalty has been to the movement and presentation of the show. The daily overhead of the Ringling Circus is around $15,000 and a succession of bad days will put a considerable crimp in a circus bankroll. Its expenses go on whether it takes in any money or not and not infrequently there is unforeseen expense involved in playing an individual stand. In Newark, N. J., the show once rolled onto a muddy lot that had been a quagmire before the twenty-four-hour man (who travels a day ahead of the show to make last-minute arrangements pertaining to foodstuffs and to the improvement of the show grounds if conditions are bad) had bolstered it with more than one thousand dollars worth of cinders and twenty tons of straw. Even then, the erection of the tents and the subsequent labor involved in putting up interior equipment shouldered the circus in all departments with a tremendous task. But the circus engineers tackled the task, the doors opened on time and business was good. The weary workers, who had labored unceasingly since dawn against time and the weather, were satisfied. They looked up at the flags floating from the halyards of the big top and they listened to the breath-taking gallop-time tempo of Merle Evans' band. They grinned. They had done it: the old "rag" was in the air!



50 CENTS A COPY

AT ALL NEWSSTANDS

Buy Your Copy Today!

All you camera fans who gobbled up PHOTOGRAPHY HANDBOOK will be glad to learn that GOOD PHOTOGRAPHY, a companion volume, is now on sale at all newsstands, at the same low price of 50 cents for 146 pages of valuable photographic information. There is absolutely no duplication of contents; everything in GOOD PHOTOGRAPHY is new and different. The lucky people who have already bought their copies tell us that GOOD PHOTOGRAPHY is the most practical, most clearly written camera manual in print—a book that enables them to make *good photographs*.

Camera tricks, exposure meter operation, night photography, infra-red, darkroom secrets, home-made apparatus of all kinds, flash gun adjustment, color projection, copying . . . the table of contents is too long to be printed here. Buy your copy today and enjoy the freshest, most authoritative photo book on the market today!

If you prefer to order by mail, use this convenient coupon. Your copy sent postpaid the day your order is received.

FAWCETT PUBLICATIONS, Inc.,
Fawcett Building,
Greenwich, Conn.

Enclosed find 50 cents. Please rush my copy of GOOD PHOTOGRAPHY.

Name .....

Street and No. .....

City and State .....

(Please do not send coin through the mails. Remit by money order, check, or unused U. S. stamps.)

TRAIN FOR **Radio in 12 WEEKS**

I WILL FINANCE YOUR TRAINING IF YOU ARE SHORT OF MONEY

Prepare for opportunities in Radio Broadcast, Talking pictures, Television, by **12 weeks of practical shop work** in the great Coyne Radio Shops, on real RADIO and Sound equipment. You don't need advanced education or experience. Free Employment Service for life. **Many earn while learning. Electric Refrigeration** included. **Mail coupon today** for free book which tells you how hundreds have become successful RadioMen after taking our training.

H. C. LEWIS, Pres., RADIO DIV., Coyne Electrical School
500 S. Paulina St., Dept. CB-1H Chicago, Illinois

Send Free Radio Book and facts. Tell me about your **"Pay-Tuition-After-Graduation" Plan.**

NAME _____ AGE____

ADDRESS _____

CITY _____ STATE_____

NOW ONLY $5.00

Over 7,000 GHQ Gas Engine Kits have been sold at $8.50. Now is your chance to buy the *New Improved* kit for $5.00. Absolutely complete with coil, plug, etc. Send only $1. Shipped Exp. Coll. for balance same day. Catalog 3c.

A SCREW DRIVER IS THE ONLY TOOL NEEDED.
AVERAGE ASSEMBLY TIME 30 MINUTES.
GHQ MOTORS, 854A East 149 St., New York, N. Y.

EARN BIG PROFITS with new RANGER SCOOTER

Earn big profits selling or renting marvelous, improved **RANGER SCOOTER.** 120 miles per gallon—30 m.p.h. Safe. Sturdy. Good territory still open. Get your share of the big profits possible! **EASY TERMS FINANCED.** Write for Free folder, Special Low Agents' Prices. Hurry!

MEAD CYCLE CO.
Dept. FS-279, CHICAGO, U. S. A.

60 POWER TELESCOPE $2.19

VARIABLE EYEPIECE. 20X—40X—60X

NEW! Three telescopes in one. 3 different magnifications. 20 power for ultra-bright images with 40 and 60 power for extra long range. Guaranteed to bring distant objects, people, sports events, ships, moon, stars, etc. 60 times as close.

Most powerful made for anywhere near the money. Closes to less than a foot in length. Multiple lens system. 30 mm. objective lens. 5 sections. Directions included for using as a compound 4 lens microscope. American made. We pay the postage. Only $2.19.

Catalog of Microscopes, Binoculars, etc. FREE on request.
BROWNSCOPE CO., Dept. 78, 5 W. 27th St., New York, N. Y.

PARKS AIR COLLEGE
PARKS AIRPORT EAST ST. LOUIS, ILL.

Offers COLLEGE and PROFESSIONAL TRAINING Majoring in AVIATION

FOUR courses lead to B. S. degrees in Professional Piloting, Aviation Operations, Maintenance Engineering, Aeronautical Engineering.

THIRTEEN TRAINING PLANES are used in professional flight training which prepares graduates for airline flight operations. 74% of graduates enter air transportation in North and South America.

64,000 hours flight training given, 650 hours being flown monthly.

FACULTY of 34 specialists in various fields of aviation.

1491 graduates. Enrollment limited to a total of 300.

100-acre airport, 14 buildings devoted to school purposes exclusively. Dormitories and dining hall at the College.

Accredited by the Illinois Superintendent of Public Instruction. Government approved as a Commercial Ground and Flying School and Mechanics' School. Open to high school graduates.

Fall Term Sept. 26th. Send postcard for new 60-page catalog.

12th YEAR **Registrar, Dept. MM-8**
PARKS AIR COLLEGE, East St. Louis, Ill.

Build This XP-3 "Pusher"

[*Continued from page* 112]

tional stringers are necessary. The entire hatch section is formed separately and lightly tacked in place so that it may be readily cut out after the fuselage is planked. (See Fig. 7.)

The front landing strut bearers, of 5/8-x 1-inch basswood are now fitted. They are first drilled and grooved to accommodate the landing struts and then slipped into place and liberally cemented to bulkheads 1, 2 and 3. The details of this part of the construction are clearly shown in Fig. 7 and Fig. 9. The wire struts should be bent over a full-size layout taken off the profile plan of the fuselage, Fig. 11.

The axle strut for the rear wheels is now formed from .125 music wire over a full size layout of this member. This may be taken off the plans, Fig. 12. The rear axle fits over the keel as shown in Fig. 10 and should be bound and cemented to the keel.

Between bulkheads No. 1 and No. 2 and between 3 and 4 a platform is laid to accommodate the dry cells, the ignition coil and the condenser. This platform may be of two-ply balsa or bass wood laminations, each 1/16-inch thick, and it is firmly glued to the longerons at the stations mentioned. The entire fuselage at this stage of the construction is shown in the perspective sketch, Fig. 7.

[*Continued on page* 143]

How Plain Is House Number

[*Continued from page* 90]

recessed numbers will usually have a light and dark side so they will be plainly discernable. But for added effect the recessed portions can be painted a dark pigment.

Some restricted residential sections with many thousands of dollars tied up in a single home and grounds may frown on the usual house numbers. Often the owner of such premises may well say "My name is more appropriate than a number." Particularly when the drive entrance is flanked by pillars or concrete piers, a simple yet ornate bronze plate will sufficiently identify the place from the street. The photograph shows a bronze name plate mounted flat against a pillar. When the house sets well back from the street, or is well hidden by landscaping, the number may well be located at the drive entrance either in the manner just mentioned or on a simple mounting attached to iron pegs which are well driven into the ground.

On page 90 is shown a striking, if unusual house number display. The frame is square iron with a double border set in the ground. A cast iron pendant depends from the top, center, while both house number and owner's name are hung from a lower bar. These letters and numbers are

[*Continued on page* 141]

$50.00 For One Picture!

[*Continued from page* 68]

and confused scenes with more than one or two central elements. Strive for pictures with definite human interest or curiosity values. The winning photographs must tell their own story in photographic terms, without elaborate written description.

This is not in any sense a prize contest, so there is no limit, and no complicated rules to observe. Submit as many pictures as you want, and be prepared to send in the negatives also if you are so requested. The size of the negative itself is of no consequence. The editors don't care if you use a 35 mm. miniature or an 8x10 studio camera, as long as the finished photographs are strikingly interesting *and have not been published elsewhere.* Prints should be on glossy or semi-glossy white paper, measuring at least 5x7 and preferably 8x10 inches. Fancy mounts are unnecessary. Mounted Kodachrome transparencies are also welcome. If black and white photos are selected for payment at $50, they will be colored by a special process developed by MECHANIX ILLUSTRATED, before they are printed in full color on the cover. Be sure to write your name and address, and a brief description of the picture, on the back of each print. Send the prints in regular photo-mailer envelopes, which cost only a few cents and afford good protection. Return postage must be included.

Photographs which are not suitable for cover use, but which are acceptable for publication in the columns of MECHANIX ILLUSTRATED, will be paid for at editorial regular rates: $3.00 to $5.00 a piece.

The editors will not limit their selection to a single picture. They want a succession of photographs for monthly cover use, and will pay $50 for each picture found satisfactory for this purpose.

Pictures From Pigmy Prints

[*Continued from page* 55]

continuous over-all panorama, to the frieze and the removable panel. One of the most talked about examples of a giant picture made from a pigmy print was installed at Miami, Fla., where a tiny "shot" 3½ inches square, was magnified to a height of 23 feet, 9 inches, with a total surface area of 27,360 square inches.

Considerable mystery prevails as to how photomurals are made but essentially the process is identical to what any amateur home photographer follows. As the first step, the photomural engineer surveys the room. Then he constructs a miniature scale model so that a photograph, properly reduced in size, can be studied in position with respect to balance and composition and for estimate of costs.

[*Continued on page* 145]

CATALOG 72
1938
CAMERA
HEADQUARTERS
CAMERA DIVISION
WHOLESALE RADIO SERVICE CO.
NEW FREE CAMERA CATALOG
Cameras, cameras — a thrilling parade of all the latest models in one big volume devoted exclusively to cameras and equipment. Send for this amazing FREE catalog today. See what you can save! See the wide selection of famous-name cameras and equipment, the completeness of stocks right down to the tiniest film clip. Mail the coupon NOW! Tomorrow you may forget all about it.
REFLECTA CAMERA
$15.75
F:4.5 Lens
WHOLESALE RADIO SERVICE CO. INC.
NEW YORK, N.Y. • CHICAGO, ILL. • ATLANTA, GA.
100 SIXTH AVENUE 901 W. JACKSON BLVD. 265 PEACHTREE STREET
BOSTON, MASS. • BRONX, N.Y. • NEWARK, N.J. • JAMAICA, L.I.
WHOLESALE RADIO SERVICE CO., INC.
100 SIXTH AVENUE, NEW YORK, N. Y.
Rush FREE Camera Catalog No. 72-22H8
it's new it's free
Name
Address
City State
PASTE COUPON ON PENNY POSTCARD

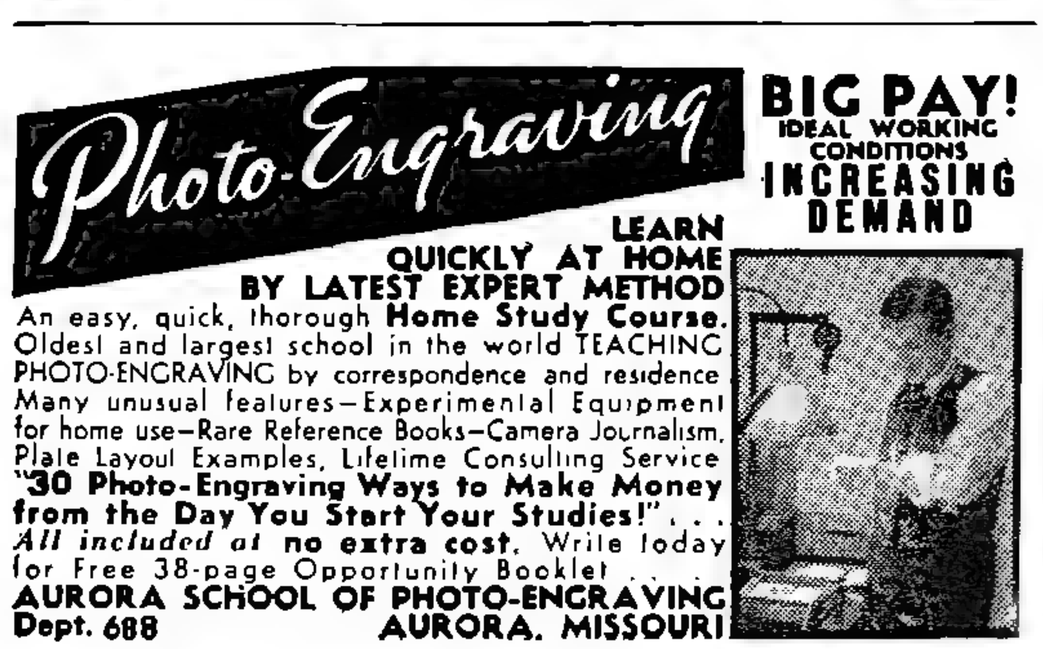


Photo-Engraving
BIG PAY!
IDEAL WORKING CONDITIONS
INCREASING DEMAND
LEARN QUICKLY AT HOME BY LATEST EXPERT METHOD
An easy, quick, thorough Home Study Course. Oldest and largest school in the world TEACHING PHOTO-ENGRAVING by correspondence and residence. Many unusual features—Experimental Equipment for home use—Rare Reference Books—Camera Journalism, Plate Layout Examples, Lifetime Consulting Service. "30 Photo-Engraving Ways to Make Money from the Day You Start Your Studies!" . . . All included at no extra cost. Write today for Free 38-page Opportunity Booklet . . .
AURORA SCHOOL OF PHOTO-ENGRAVING
Dept. 688 AURORA, MISSOURI

NO MORE Spoiled FILM!
$1.95
NOW—PERFECT PICTURES WITH ANY CAMERA!
For movies or stills. Eliminates guesswork; insures perfect "shots," even in poor light. Automatically corrects for speeds, filters, subjects, etc. Case, 35c. At all Dealers.
Univex EXPOSURE METER
Beach-Sea-Snow-Sky
Univex

SNUBBED BECAUSE OF "ADOLESCENT SKIN"?

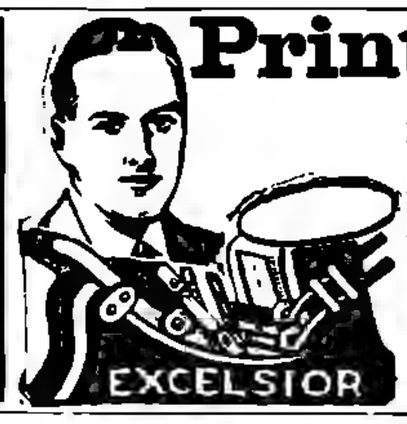
Act now to help keep your blood free of pimple-making poisons

Don't go on being cursed by loathsome pimples. Don't make others feel ashamed of you or shun you. Find out what's the matter and correct it.

During the period of adolescence, in the years between 13 and 25, important glands are developing. This causes disturbances throughout your body. Waste poisons from the intestines often find their way into the blood . . . and may break out in ugly skin eruptions. You must help free your system of these intestinal poisons.

Thousands of young people have solved this problem—simply by eating Fleischmann's Yeast. Each cake of this fresh food contains millions of tiny, *living* plants that act to help you eliminate waste poisons from the body—*before* they can get into the blood. Your skin becomes clearer and fresher again. Many get remarkable results in 30 days or less. Don't lose time. Start eating Fleischmann's Yeast *now* . . . 3 cakes daily, one before each meal.

Print Your Own



Cards, Stationery, Advertising, labels, paper, circulars, tags, etc. Save money and time. Sold direct from factory only. **Junior Outfit $9.00.** Senior outfits $17 and up. Do popular raised printing like engraving with any of our presses.

Print for Others, Big Profits

Pays for itself in a short time. Easy rules sent. Write for free catalog of outfits and all details.

KELSEY PRESSES, D-9, Meriden, Conn.

Big Profits ASSEMBLE YOUR OWN KAYAK ... IT'S EASY

ESKANOE KAYAKS NEW LOW PRICES

Send 10c. Postage for assembling plan & big catalog

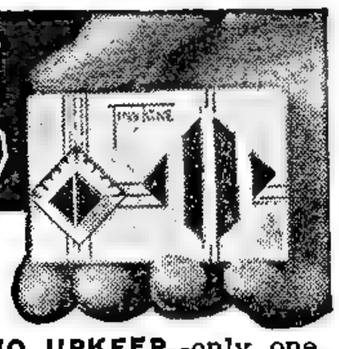
No experience required. 16 new models, 10 to 20 ft.—1 to 4 persons. Safe, light, non-sinkable. Best materials. Complete cut to fit assembling kits. $6 paddle free while they last.

KAYAK BOAT CO., Dept. M
152 East 129 St. N. Y. City

WOOD-WORKING SUPPLIES

New 100 page book contains most complete list of woodworking supplies in the world—Standard American woods cut-to-size at bargain prices. Rare imported woods. Veneers, plywoods, inlays, carved legs, mouldings, decorations, special tools, Hard-to-find ornamental hardware, scroll saw patterns, wood-finishing instructions—How to make Venetian Blinds at 1a store prices. Send only 10c for Catalog No. 10 to **Craftsmen's Wood Service Co., 2742 S. Mary Street, Chicago, Ill.**

At Last! A WIRELESS TUBELESS BATTERYLESS Pocket Radio



WORLD'S SMALLEST REAL PERFORMING RADIO

Midget radio fits your pocket or purse. Complete in one unit—weighs only 3 ozs. Smaller than cigarette package! Receives stations with clear natural tone. **NO CRYSTALS** to adjust—**NO UPKEEP**—only one moving part. Self contained "Speakonphone" unit gives superior performance. IS NOT A TOY! **THOUSANDS OF SATISFIED OWNERS**—Many report amazing reception and distance. Sent complete with instructions for use in home, offices, hotels, boats, in bed, etc. **TAKES ONLY A SECOND TO CONNECT.** No hook-ups to any current. Six colors available.

SEND NO MONEY! Pay Postman only $2.99 plus postage on arrival or send $2.99 (Check, M. O., Cash) and yours will be sent postpaid. GUARANTEED. A most unusual value. ORDER NOW!

TINYTONE RADIO CORP. Dept. M-8 KEARNEY, NEBR.

How To Make Electromagnets

[*Continued from page* 105]

pack, and the edges turned over with a mallet.

Alternating Current Magnets: When electromagnets are to be used on alternating current, the core must be made of laminated sheet-iron (soft stove iron) or transformer steel, and a return path for the magnetic circuit should be provided. The one shown in the illustrations is of standard type and very efficient. While the core may be built up from strips of iron, the same as in making the core of the welding transformer mentioned previously, a simpler method for the beginner is as follows: Squares of sheet iron are piled up to the correct thickness, riveted togther at five or six places, and the space for the coil cut with a hack saw or power saw. The coil then is slipped over the middle leg. When winding it the turns must be counted.

Measurements for two a. c. magnets will be given; the first is for operation with a small 8 volt transformer. Cut the stove iron into 2"x2" squares to make a pile ½" thick; then rivet them together and saw out two sections so that the middle leg will be ½" wide and each outside leg ¼" wide. Wind coil with 150 turns of No. 18 wire. For a 110 volt a. c. magnet use a pile of iron 2"x3" and 1" thick and remove sections so that the center leg will be 1" square, the outside legs each ½" wide. The coil consists of 500 turns of No. 22 wire.

Use of the higher mathematics together with considerable experimentation are necessary in computing the size of core, wire and amount of traction in designing an electromagnet for a given purpose, and it is for this reason that no attempt has been made to state any of the rules or methods here. The traction is governed by the strength of the current in ampere turns, but the final result is dependent on the permeability of the iron core; that is, the ability of a particular kind of iron to conduct a given number of lines of magnetic force. Practically no two kinds of core material are exactly alike in this respect, so no exact rule can be formulated so as to be satisfactory to anyone but an electrical engineer of wide experience.

. . . Spice Your Lawn . . .

[*Continued from page* 101]

what smaller, he is cut from solid wood ⅝ inch thick. The doodle bug is in two parts and a stiff corset stay, a hack saw blade or a short length of a clock spring connects head and body with enough freedom that the head nods slowly to and fro in a breeze. The spring is held on edge against the back side, really forming the neck, and stiff wire, bent to form a very thin staple—just wide enough to fit over the spring—is then driven into the wood. To say that this freak draws many a glance puts it mildly.

10,000 Miles An Hour!

[*Continued from page 49*]

instruments which are now taken aloft for observation by small balloons and airplanes.

Just what is a rocket? Well, a rocket is simply a variation of your own Fourth of July skyrocket, with its hollow tube and pointed cap containing a smaller cylinder of compressed gunpowder. You light its fuse, the flame runs up and ignites the powder which blows off with a hiss through an opening at the base of the tube. It blows off because the burning powder produces gas which expands causing a pressure that forces it out.

The reaction thus produced causes the skyrocket to develop a thrust in the opposite direction —the thrust being equal to the mass of the ejected gas multiplied by its velocity. This recoil is independent of the surrounding air; it is like the kick of a gun. It operates in accordance with Newton's third law of motion, i.e., the force acting on the gases to eject them from the rocket has an equal and opposite reaction on the rocket itself.

What are the main stumbling blocks to perfect rocket flights today? First is a motor that will not burn out from the intense heat of combustion. The solution appears to lie in cooling the motor by its own fuels circulating through its walls. Several motors of this type now are being tested. They are called regenerative motors. A most likely design is one by Mr. Wyld, a young Princeton engineer hitherto mentioned. Mr. Wyld's motor is about 14 inches long and weighs a little more than a pound. It is made of aluminum. The nozzle, where the heat is fiercest in rockets—sometimes 3,000 degrees F.—is very thin nicrom. The fuel flows through a jacket on the outside of the motor. It cools the motor and simultaneously carries the heat back to it. The cooling process fights off heat in the same way water running through metal resists an acetylene torch.

The second problem, now close to solution, involves stabilization of the rocket in flight. Recently tests to this end were completed by experimenters of the American Rocket Society at Pawling, New York. The results of these tests form the working basis of new rocket body designs now being given tryouts. At Pawling, seven different models of rockets conceived by society members were put through the hurdles. All of them were constructed of balsa wood and cardboard tubing, the work of H. F. Pierce.

Rocket men everywhere are waiting for the results of summer activities. Out of them may emerge a motor and its appurtenances which may take the rocket out of its Kitty Hawk era. If this happens, you can expect to see rockets gathering weather air mass data, carrying messages and mail in war and peace, and soon after short trips with human beings, say from New York to Cleveland or Washington.

For the present we'll postpone that moon trip, for it is estimated a rocket capable of getting there would have to be as big as the Empire State Building and would cost a paltry $1,000,000,000!

A CLOGGED radiator may be the beginning of an expense account. The motor overheats. You lose power. Expensive repairs often result from a neglected radiator. Don't take a chance. You can keep radiators clean with SANI-FLUSH. Keep motors running cool and efficiently.

Just pour 10c worth of SANI-FLUSH in the cooling system of your car. (25c for the largest truck or tractor.) Follow directions on the can. Run the engine. Drain. Flush. Refill with clean water. It takes very few minutes and SANI-FLUSH removes rust, scale and sediment. It cannot injure motor or fittings. You'll find SANI-FLUSH in most bathrooms for cleaning toilet bowls. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 25c and 10c sizes. The Hygienic Products Company, Canton, Ohio.

Sani-Flush Safe NOT CAUSTIC

KEEPS RADIATORS CLEAN

NOW a DYNAMIC HEAVY DUTY INDUSTRIAL WELDER for Only **$19.75** RETAIL

WORKS Off 110-Volt Light Socket. This marvelous **Dynamic** Power Welder does the work of much higher priced types. It is easily portable. **WELDS Cylinder Blocks, Bumpers, Fenders, Tanks, Farm Machinery, etc.** Will also solder and braze on the lightest material. Works on iron, steel, tin, brass, copper and all other metals. Men without previous experience can make as much as $5.00 on a one hour repair job. Go into business—Open a Welding Shop Now. **AGENTS**—Make big profits selling to garages, factories, janitors and machine shops. WRITE for 10-Day Trial Offer. **DYNAMIC WELDER COMPANY 2226-EZ SILVERTON ROAD, CHICAGO, ILLINOIS**

Mental Poisoning!

Thoughts that Enslave Minds

Tortured souls. Human beings whose self-confidence and peace of mind have been torn to shreds by invisible darts—the evil thoughts of others. Can envy, hate and jealousy be projected through space from the mind of another? Do poisoned thoughts, like mysterious rays, reach through the ethereal realms to claim innocent victims? All of us, from day to day and hour to hour, in every walk of life, in every circumstance, are possible victims of mental poisoning, unless we understand its nature, and can quickly recognize its infectious innoculation.

This FREE Sealed Book

Do you know the strangest of all laws in man's body? Man's life, happiness, health, and enjoyment of the things of life depend on his understanding of the working of the human mind. Let the Rosicrucians explain how you may acquire an age-old method for mind development and the proper use of your latent inner powers. If sincere, write for the *free sealed book*. Address: Scribe F.H.V.

The ROSICRUCIANS
(AMORC)
San Jose, California

EARN MONEY

Make Color-glazed Concrete Products

New, perfected low cost method. No molds, power or costly tools. You build your own equipment from plans we furnish. Experience not necessary to make color-glazed concrete garden pottery, statuary casting, giftware—in home or shop—to earn money. MEN—Send 10c TODAY for booklet, colorplate, details of this money making business. No obligation.

NATIONAL POTTERIES COMPANY
Room 8, 13 W. 26th St.
Minneapolis, Minn.

WIND DRIVEN Electric PLANT

Build Your Own—We Show You How

Make auto generator light buildings, play radio, run washing machine and other motors from FREE WIND POWER. Earn money making for others. Dime brings complete building plans and 1938 catalogue listing over 500 windcharger electrical items. Most complete windcharger catalog; welders, electric fence, etc., over 100 other generator changes into 6-12-32 and 110 volt plants.

LEJAY MFG. CO., 414 LeJay Building, Minneapolis, Minn.

New Catalog of
TRAILER PARTS

New catalog of trailer parts at bargain prices. Axles, straight, $4. Drop center axle, $7.50. Drop center axle undercarriage, $19.50, complete less tires. Cable-controlled brakes on axle, $15 extra. Electric brakes—prices on request. Send for FREE Catalog today.

Shamrock Trailer Parts, 12319 Turner, Detroit, Mich.

LES — A AD ASTRA PER ARDUA

Correspondence Courses In
RADIO and ELECTRICAL ENGINEERING

SPECIAL Only $25

ELECTRICAL ENGINEERING Get good grasp of wide electrical field. Prepare yourself, at Low Cost, for secure future. Modern course. So simplified anyone can understand quickly.

RADIO ENGINEERING Extra fine course in radio, public address, photo-electric work. Trains you to be super-service man, real vacuum tube technician. Experimental kits furnished. Diploma given on completion. Tuition, ONLY $25, either course. Deferred payment plan available.

FREE! Send name quick for free copies of school catalogs student magazines, complete details. SEND NOW.

LINCOLN ENGINEERING SCHOOL, Box 931-92, Lincoln, Nebr.

Simple Plumbing Repairs

[*Continued from page* 116]

After a faucet has been turned on and off several thousand times the washer is certain to wear out or become rough, thus allowing a little water to seep by. At the first sign of such leakage, borrow a tire wrench from the car's tool kit and fix the faucet.

After first turning off the main supply valve where the water pipe enters the house, loosen the head of the faucet as shown in the picture. To prevent damage to the fixture, put small pieces of plywood next to the wrench jaws. One good pull will loosen the threads and enable you to remove the top. The washer is held by a single brass machine screw, and is easily taken off.

A whole box of assorted faucet washers costs only a dime. Pick one of the right diameter, refasten the screw, turn the faucet head back on, and the job is finished. Nothing could be simpler.

It is a wise idea to test the "feel" of all faucets in the house every few months. They should not close hard, but with a definite softness, which indicates that the washers are in good condition.

The other common source of trouble in the home plumbing system is the U-shaped trap under the kitchen sink. All drain pipes have such traps, whose purpose is to prevent sewer gas and sewer odors from backing up into the house. The kitchen trap is most likely to clog up because of accumulation of fat and grease from dishes, plates, etc. Washtub and hand basin traps rarely require cleaning out because they pass only comparatively clean water.

The tire wrench used before will loosen the drain plug in the trap. Place a pail under the pipe to receive drippings. To remove solid matter, use a piece of wire and flush out thoroughly with hot water. It is not advisable to flush sinks with the usual "bowl cleaners," as these compounds are nothing but ordinary sodium hydroxide—common "caustic soda"—and this will ruin enameled iron sinks. A few minutes of poking with a wire or an old brush will do the trick.

How To Moor The Small Boat

[*Continued from page* 115]

will hold a small boat if the weight is heavy enough. An old motor block will hold any small boat up to twenty feet; a better anchor is a flat block of concrete with a ring bolt cast in its center. A car wheel with a bolt through the center forms another excellent anchor. All of these of course are for permanent moorings where the anchor does not have to be taken aboard the boat. A good anchor for a rowboat is to fill a gallon paint can with concrete and cast a "U" reinforcing bar in the top. A large stake driven in the bottom forms an exellent perma-

[*Continued on page* 146]

How Plain Is House Number

[*Continued from page* 136]

painted black, but came from the counters in a dime store. Since black will silhouette well against almost any color and because the lot rises abruptly from the street, this name and number is conspicuous from the road.

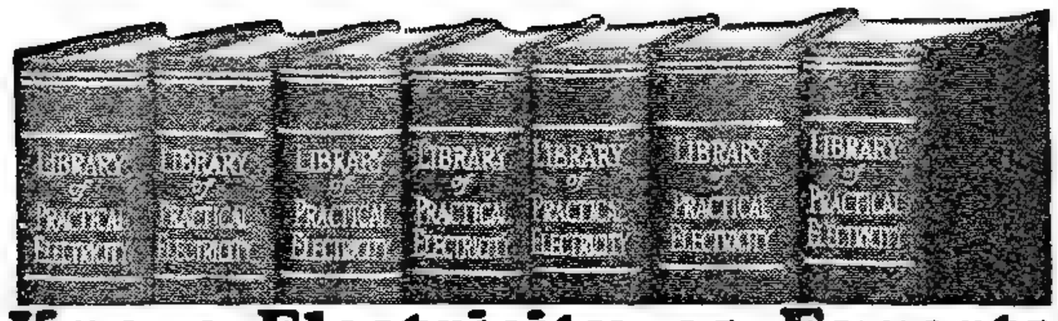
The owner of a home of tan brick desired a neat but different style of number to place beside the front door. A blacksmith made the number shown but any craftsman could duplicate it because the only tools necessary are, hammer and cold chisel. The stock is wrought iron ⅛-inch thick. The numbers were laid out in chalk on the iron blank, then cut out one at a time. A strip tie of the metal connects the 3001 along their tops and bottoms, then the piece was polished, washed in a soda bath to clean and enameled in black. A small drive pin was then put through a hole in each corner and driven into holes drilled in the brick which had been plugged with lead.

The house number can be incorporated in the mail box design which is fastened to the wall beside the door inside the porch. To further accentuate good taste a Cape Cod metal lantern is hung directly above for a nicely balanced vertical composition. The strap irons below the box are capacious enough to hold a newspaper. The back panel of the box merely continues above the top of the box to provide space for the number to be cut from. This, too, is another good home shop project which may be varied to suit individual tastes and needs. The top of the box is hinged and all of the five remaining pieces, ends, sides and bottom, are fastened with brass bolts which go through light angle irons at the corners inside.

Driving down a street recently after dark, we noticed an unusual house number. It was visible a block away and easily read from across the street. Its numbers were luminous, different. Here was a number as easy to read after dark as during daylight hours.

The handyman had contrived a rectangular box, cut the numbers in the front side, wired it and provided two sockets for 25-watt lights inside then connected up the whole affair with a switch just inside the front door. Whenever guests were due it was a mere matter of pushing the switch to point out the house.

Half inch white pine was used to make the box. It measured 5 inches wide, 7 inches high and 16 inches long although the length was somewhat governed by the size of the number. Block numerals were used, these being laid out in pencil until well balanced and correctly designed. Then they were jig sawed out and the cutout portions such as those of the number "8" and "4" were saved. With the box completed, the top was made and quarter round tacked to the under edges to make a tight fit.



Know Electricity as Experts Know It—and Get an Experts Pay!

Recovery has begun! The months ahead are charged with significance and expectation. What will you do to get the jump on the other fellow?
Thousands of men have used

The Croft Library of Practical Electricity

The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hard-headed facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers. Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—wiring for light and power—wiring of finished buildings—underwriters' and municipal requirements—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from estimating it, to completion.

No money down—easy payments

Fill in and mail the coupon attached and we will send you the entire set of seven volumes for ten days' Free Examination. We take all the risk—you assume no obligation. If you decide to keep the books, send $1.50 in ten days and the balance at the rate of $2.00 a month. Send the coupon NOW and see the books for yourself.

FREE EXAMINATION COUPON

McGRAW-HILL BOOK CO., 330 W. 42nd St., New York

Send me for ten days' free examination the Croft Library of Practical Electricity. If satisfactory I will send you $1.50 in 10 days and $2.00 monthly until the price of $19.50 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name ----------
Home Address ----------
City and State ----------
Position ----------
Name of Company ----------MMx-8-38

LEARN WATCH REPAIRING

AT HOME You can learn by our modern and original system of instruction every part of the Watch repairing Trade at home. You can earn money while learning and prepare yourself for a well paying position or start in business after completing our course of instruction. Good watch repairers are in demand and generally earn very good salaries. For particulars apply to the

WISCONSIN SCHOOL OF WATCH REPAIRING
524 E. Mason St., Dept. C, Milwaukee, Wis.

HAVE YOU SOME SPARE ROOM

a basement or garage where you can do light work? We can offer you a profitable proposition, casting 5 & 10¢ novelties, ashtrays, toy autos, etc. as Manufacturer for firm of many years standing. No experience necessary as we furnish full instructions with moulds. If interested in devoting spare or full time to profitable work write AT ONCE stating age and space available as we are now closing arrangements for 1938 supply of our goods.

METAL CAST PRODUCTS CO.
Dept. 2, 1696 Boston Road, New York, N. Y.

BE A RAILWAY TRAFFIC INSPECTOR

LET US HELP YOU TO A WELL-PAID JOB!
MEN—19 to 50—trained as *Railway and Bus Passenger Traffic Inspectors* earn good pay to start and advance quickly with experience. Simple, home-study course qualifies you and upon completion, we place you at up to $135 per month, plus expenses, to start, *or refund tuition.* Free Booklet outlines 19-yr. record.
Standard Business Training Institute, Div. 6108, Buffalo, N. Y.

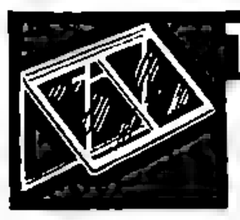
Learn AVIATION

Come to LINCOLN PREPARE NOW AT THIS GOVERNMENT APPROVED SCHOOL

for a good position as Pilot or Mechanic. Air Transport Pilots earn up to $6000 a year: Aviation Mechanics up to $2400. LINCOLN'S **FLIGHT TRAINING** prepares you for your Government Rating as Transport, (Commercial), Limited Commercial or Private Pilot. 14 Training Planes; Veteran Instructors; Large, modern Airport. **LINCOLN'S GOVERNMENT APPROVED MECHANICS TRAINING** gives you practical experience in modernly equipped Shops and Laboratories. Prepares you for immediate employment with Government Rating as Airplane and Engine Mechanic.

POSITIONS FOR MORE LINCOLN TRAINED MEN. Through our employment service, Lincoln Graduates are regularly taking positions with leading companies. **WRITE TODAY** for complete information.

LINCOLN AIRPLANE & FLYING SCHOOL
508 Aircraft Building **Lincoln, Nebraska**



TRAILER BUILDERS

Lowest prices in the trailer industry, for windows, couplers, lifting devices and many other items needed by trailer builders. Largest stock in America. Prompt shipment. Send 10c for 40 page illustrated catalog.

MARVEL TRAILER PARTS CO.
19024 Celestine **Detroit, Mich.**

Learn Photography at HOME

Splendid opportunities. Prepare quickly in spare time. Easy method. No previous experience necessary, common school education sufficient. Many earn while learning. Send for free booklet "Opportunities in Modern Photography", particulars and requirements.
AMERICAN SCHOOL OF PHOTOGRAPHY
3601 Michigan Avenue Dept. 205-C Chicago, Illinois

PHOTOGRAPHIC ALMANAC Free!

Free 1938 Almanac Includes (1) Special month-by-month **Photographic Calendar.** (2) Authoritative photographic article. (3) Handy Exposure Table, Exposure Guide. (4) 100 pages of still & movie cameras, films, lenses, enlargers, chemicals—everything photographic—many at big savings ALL GUARANTEED on 10 Day Money Back Trial. (Used equipment accepted in trade.) Write for Free copy!
CENTRAL CAMERA CO., (Est. 1899) 230 S. Wabash, Dept. J-8, Chicago

CANDID BARGAINS NEW and USED CAMERAS AND ACCESSORIES Write To-DAY

WE'RE SERIOUS!

If you are—Get our special trade-in allowance on your old equipment. Bring it up-to-date economically with our Bargain Prices. Write today.

NEW YORK CAMERA EXCHANGE
109 FULTON ST., NEW YORK CITY, DEPT. MX8
CAMERA EXCHANGE ORIGINATORS SINCE 1890

Become an expert photographer

Send for big free booklet that tells how you can become an expert in **Commercial, News, Portrait, Advertising** or **Motion Picture Photography.** Big money-making opportunities. Personal Attendance and Home Study training. 28th year.

NEW YORK INSTITUTE OF PHOTOGRAPHY
10 West 33 St. (Dept. 153) New York City

Keep A Record

[*Continued from page* 120]

processed you have no way of telling just what they are. If you experiment with different makes and types of film (and what camera owners don't?) these notebook sheets offer an invaluable means of comparing general results. The kind of developer, the temperature and the developing time are likewise noted, with a remark as to whether the negatives had satisfactory contrast. Since practically all roll film is tank-developed by the time-temperature method, this information enables you to compare the relative effectiveness of different developers.

Under "subject," the name of the person or a very brief description of the scene will serve as identification. Under "light," write down good sun, dull, cloudy, etc. Some people find it helpful to add the actual time of day, as certain types of films are noticeably faster than others early in the morning or late in the afternoon, when the sun is not at full strength. If you have a photoelectric type exposure meter, supplement this information with a record of its reading.

If no filter is used, leave the last space blank. If you do use one, it is a good idea to try two exposures of the same scene, one with the filter and the other without, or two with filter and one without. By trying different exposures, you will soon determine the correct multiplying factor for that filter for each particular film.

A less elaborate record, like the one shown in photo B, (page 120) is satisfactory if mere identification of negatives is all that is required. Shutter speed and lens stop constitute the technical information, with bare notations of the scenes themselves. The main value of a record of this kind is the comparison it offers of the "stopping" effect of different shutter speeds. If you find that 1/50 second, for instance, made a slightly blurred picture of a child just learning to walk, you'll know that 1/100 second will have to be used the next time.

One meticulous camera fan of the writer's acquaintance uses regular 3x5-inch file cards for his exposure data. He keeps them neatly in a small wood file case, and makes a habit of studying them during off moments—when film is drying, solutions are filtering, etc. This way, he says, he learns more about practical picture making than through reading a couple of books!

Landlubber's Shuffleboard

[*Continued from page* 87]

seven disks of each color. One disk of each set should have a white star painted or glued on each face; star disks count double value.

The Hot Spot is a 4½-inch diameter circle painted on the base, about 15 inches in front of the barricade. If a disk stops so that it lies *completely* inside the Hot Spot, it doubles the scores of all the other disks of that color.

Build This XP-3 "Pusher"

[*Continued from page* 136]

Before proceeding further with the fuselage assembly it is necessary to build and install the center section. The center section is built up as shown in the detail sketches, Figures 14 and 15. Take the beam lengths from the plan, Fig. 12 and assemble these spars first. The portion of the spars which lies in the fuselage is best covered as far as possible with the necessary webbing before the spars are inserted. The rest of the truss and web work is done after the ribs have been put in place. The partially completed spars go between bulkheads No. 5 and No. 6 and Nos. 8 and 9 respectively. The front spar is cemented directly to the longerons but the rear spar is not cemented down until the ribs have been prepared and No. 1 center section rib fitted. This is because in order to obtain the required zero incidence it will be necessary to block up the rear spar until this position is arrived at. (See Fig. 11.) Note that the center section spars are ¼-x½-inch as against 3/16-x½-inch for the wings.

Lay out a full size pattern of the rib section from the squared profile given in Fig. 13 and cut out the ten ribs needed from 3/32-inch sheet balsa. All the center section ribs may be cut full size and the trailing edges clipped off later to produce the plan form shown. The resultant trailing edge is therefore quite blunt at the fuselage end. (See Fig. 14.)

Assemble the ribs in their proper positions and note that before putting in the end ribs it will be necessary to build and fit the boom stubs (Fig. 16) which are cemented against the two end ribs. Details of this construction are clearly shown in the drawings (Fig. 14-15) and it is only necessary to add that the wing fitting blocks and the rear landing V-struts must be built in at the same time. The wing fitting blocks serve to take up all loads imposed on the wing bolts and should therefore be of hard wood. Close the ends of the boom stubs below the front spar with pieces of the wall material and drill a hole large enough to accommodate a socket wrench or screwdriver in the upper and lower walls of the stub directly above the location of the rear wing bolts. Stubs must be aligned exactly before cementing down.

Sand down the entire boom stub, cover tightly with silk and apply three coats of regular aircraft dope. Bind the stub with thread near the mouth to guard against splitting and proceed with the centersection by putting in the leading and trailing edges, leaving them unshaped until after the planking has been laid.

The planking, of 3/32-x½-inch soft balsa is now put on the top and bottom of the entire center section. Sand it down to 1/16-inch and complete the airfoil section of the leading edge before covering with silk and doping. The trail-

[*Continued on page* 144]

Elto
PAL $37.50
WEIGHS ONLY 14 POUNDS
THOUSANDS of sportsmen testify to the supreme handiness of this motor that weighs only 14 pounds . . . the unbeatable economy of 6-hour operation on one gallon of fuel . . . and the capable power that drives a good sized boat up to 6 miles an hour. Easy to start, quiet and dependable.
WRITE FOR FREE CATALOG
Get full information on the Elto Pal, the Ace, speed up to 7 miles, only $47.50, Handitwin, two cylinders, speed up to 8½ miles, $67.50. Complete catalog sent on request . . . also Boat Directory and Boat and Motor Selector — all free. Address EVINRUDE MOTORS, 5521 N. 27th St., Milwaukee, Wis.
Prices F.O.B. Milwaukee.
Elto
OUTBOARD MOTOR BOAT

TRIAL LESSON IN
FREE • DRAFTING

More good jobs now in Drafting. Learn AT HOME in spare time (or at our Chicago School). Send post card for FREE TRIAL LESSON and see how easy to learn and get a good job.

CHICAGO TECHNICAL COLLEGE
K263 Tech. Bldg., 118 E. 26th St., Chicago, Ill.

If you can go away to college to learn Drafting, Engineering, Architecture, Electricity, Air Conditioning or Radio—send for FREE Blue Book.

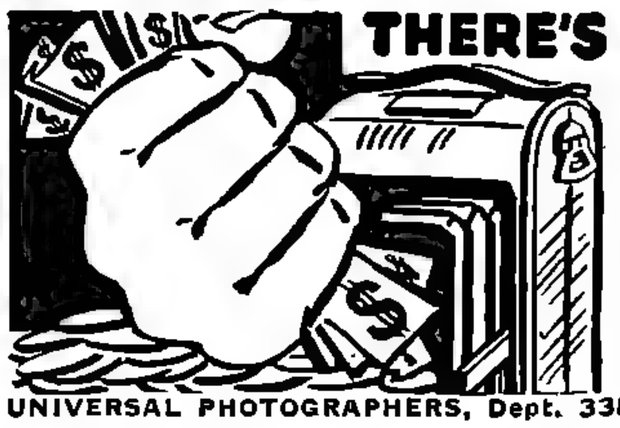
BILD-UR-OWN
COASTERS · MIDGET AUTOS · SCOOTERS · BIKE TRAILERS, ETC.
SOAP BOX DERBY WHEELS

You are guaranteed complete satisfaction when you buy our DISC WHEELS and balloon tires.

(GOODRICH—GOODYEAR—FIRESTONE)

At lowest prices. We provide Scooter Kits at big savings. Build Now! We also carry larger Tires, Wheels, Motors, etc. Write for prices.

BILD-UR-OWN DEVICES, 5237 Lake St., Dept. B-8, Chicago, Ill.



THERE'S MONEY IN YOUR CAMERA!

Others make good incomes selling pictures to publications. FREE CATALOG describes home-study course (which may be paid for in easy installments) and tells how YOU can do it too!

UNIVERSAL PHOTOGRAPHERS, Dept. 338, 10 West 33 St., N. Y. C.

All Aboard!

for a Wonderful VACATION TRIP

Auto-Glide

120 MILES PER GALLON!

Here you go!—on the most thrilling trip of your life! Travel 200 to 300 miles daily, comfortably—only 50c to 75c a day for gas! See other states, cities, mountains, lakes—at almost no cost. The genuine Auto-Glide, made by a foremost engine builder, has the ruggedness, power and comfort for long trips. Extra strong welded frame. Powerful 1½ or 2 H.P. Cushman engine (2-speed transmission) climbs steepest hills. In high, up to 35 miles an hour. Clutch makes it easy to stop at crossings, intersections. 2 or 3-wheel models. Kari-Pac model has big luggage carrier. Magneto or battery. Starter, brake, light, hand-accelerator, balloon air tires, etc.

Ideal for deliveries. Cuts costs 'way down.

FREE BOOK! See your dealer or write for full details, book, Low Prices.

CUSHMAN MOTOR WORKS, Dept. B-8, Lincoln, Nebr.

AUTO-MECHANICS & WELDERS

Auto Mechanics and Welders are in big demand. Complete courses in arc and acetylene welding, metal finishing, body and fender bumping, spray painting. Special low rates. Pay after Graduation Plan. Write today.

Write for FREE CIRCULAR

MICHIGAN TRADE SCHOOL
3763 Woodward Ave., Detroit, Mich.

CARTOON YOUR WAY TO SUCCESS!

DON'T COPY - LEARN TO ORIGINATE!

RAYE BURNS will teach you HOW to CREATE ORIGINAL CARTOONS at home that you can SELL! Course has 26 lessons and 600 illustrations. *Send name and address for free details.* Only.... **$2.85**

RAYE BURNS SCHOOL, Dept. F, Box 2194, Cleveland, Ohio

Learn Profitable Profession in 90 days at Home

Salaries of Men and Women in the fascinating profession of Swedish Massage run as high as $40 to $70 per week but many prefer to open their own offices. Large incomes from Doctors, hospitals, sanitariums and private patients come to those who qualify through our training. Reducing alone offers rich rewards for specialists. Write for Anatomy Charts, and booklet—They're FREE.

THE College of Swedish Massage
1601 Warren Blvd. Dept. C58, Chicago
(Successor to National College of Massage)

Kills Lice, Ants, Fleas, Aphids, Bedbugs, Crab Lice, Potato Bugs, Leaf Hoppers, Cabbage Worms, Mexican Bean Beetles

25c & 50c Locally or From O.S. Co., Elkridge, Md

250 CHANCES to MAKE MONEY

Yes! Every time you call on a housewife with my big Display Outfit, you have over 250 chances to make money, because you handle over 250 daily home necessities—things people must buy. Earnings up to $45 very first week. No experience needed. Liberal credit plan. I give New Ford Sedans or $500 Cash as a bonus. Limited openings. ACT QUICK! Write for Free Facts!
Albert Mills, 5339 Monmouth Ave., Cincinnati, Ohio.

Build This XP-3 "Pusher"

[*Continued from page* 143]

ing edge should be slightly rounded at the blunt portion to cut down possible burble at this point.

We can now complete the fuselage. Put in the necessary wiring from the battery compartment to the motor station and plank the entire fuselage with 1/8-x3/32-inch soft balsa strips running fore and aft. The strips should be trimmed to lie flat and to fit snugly against the butt ends of the center section. Cover the hatch and fuselage in one piece as the hatch is cut out later, after the fuselage is finished. The nose, cabin top and tail blocks are now fitted. Carve these pieces out, the nose block from the squared diagram given in Fig. 11, the others by eye, and cement them in place. Use soft balsa for the blocks and carve slightly larger than is necessary to fit so that they can be sanded smooth to the specified dimensions.

Sand down the entire fuselage with fine grade sandpaper. After sanding, the planking thickness should not exceed 5/64-inch. Apply two coats of nitrate dope before covering with silk and then apply the usual three coats of regular aircraft dope.

The hatch can now be cut out and fitted with a spring brass clip to form a press fit on bulkhead No. 2 to permit ready removal. This clip can be arranged to embody a spring contact with the batteries—thus serving as a contact switch when the hatch is in place. Before the fuselage is covered with silk, the cabin windows and windshield opening should be cut out. These openings may be left blank or covered with celluloid as desired.

Attach the spreader axle to the V-struts with tinned wire and solder. Fit the 4½-inch airwheels and the rear landing gear is complete. The front axle, a short length of .125 music wire is similarly fitted with a 3½-inch airwheel between the struts to complete the front landing gear.

The fuselage is now completed and we are ready to take up the construction of the tail unit and the wings which will be dealt with in the succeeding and final installment of this article, which will appear next month.

(Editor's Note:—The XP-3 is scientifically designed. Do not attempt any changes in the basic design. Dimensions as given take precedence over lines if minor divergences occur in the plans.)

So great is the force of a tornado that the wind sometimes drives straws into pieces of wood.

All boys like to shoot and YOUR son will be thrilled if you build the "Harmless Target Gun" to be described in the September MI. Featuring all-wood construction, the gun shoots rubber-tipped dowels.

Pictures From Pigmy Prints

[*Continued from page* 137]

The negative, after retouching to remove blemishes, now goes to the projection room. The screen is a sheet of sensitized photographic paper tacked to the farther wall. On this the negative's image is cast by a huge projection camera. This machine, 4x6x8 feet in dimensions, rests on wheels running along a four-foot gauge track. With its lenses, condensers and 5,000-watt lamp of airplane-beacon type, the camera weighs 450 pounds. Special ventilation apparatus keeps it cool and an ingenious device protects the negative from the lamp's heat.

After exposure the long strip of paper is developed in large tanks. The developing process is like that employed in ordinary photography. Tanks vary in length up to ten feet and a large job consumes about 800 gallons of developing solution.

Following the fixing bath, the photomural moves to the washing tanks. Constructed of stainless steel to eliminate chemical action, these hold 400 gallons of water, filtered and tempered and made to circulate around, up and over the paper. Again timing is carefully clocked and chemical tests are made to detect the slightest traces of hypo before the loops of paper are lifted out and adjusted on drying racks of steel webbing through which air circulates freely.

The "skiving" process which follows involves tearing the side edge of the print on a bevel, so that two sections may be lapped together with the least possible visible joint. Mounting is done in various ways, depending on the job, but in most cases a strip of chemically pure white muslin serves for an immediate foundation. Specially developed paste prevents chemical action that might cause blemishes. A "spotter" then inspects the job to eliminate minor defects that escaped the retoucher's magnifying glass.

From the negative to the wall on a small job might be a matter of less than twelve hours for a crew of two or three men. Larger jobs call for more men and more time.

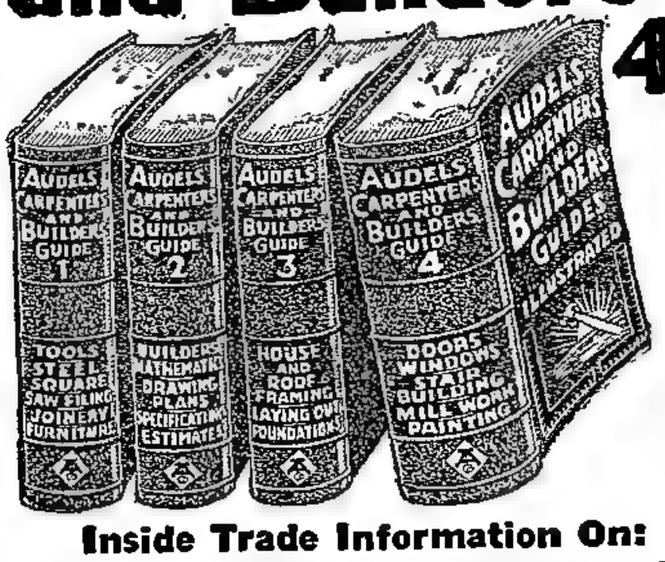
That development of photomurals has not been as simple as this account sounds Mr. Clason emphasizes. He has seen "hot spots," caused by unslaked lime in the plaster, start discolorations that ruined an entire job.

Lengthy research was required to determine the chemical effect of muslin on photographic paper and a dozen types of wall board were investigated before suitable mounting board was selected. Photographic paste went through various changes in formula. When atmospheric gases were discovered to cause discoloration a search was started for the right kind of lacquer to use as a protective agent. This formula was also revised several times.

Photographic supply companies have made many changes in paper stock to provide a more

[*Continued on page* 146]

AUDELS Carpenters and Builders Guides 4 vols. $6


AUDELS CARPENTERS AND BUILDERS GUIDE 1
TOOLS STEEL SQUARE SAW FILING JOINERY FURNITURE
AUDELS CARPENTERS AND BUILDERS GUIDE 2
BUILDERS MATHEMATICS DRAWING PLANS SPECIFICATIONS ESTIMATES
AUDELS CARPENTERS AND BUILDERS GUIDE 3
HOUSE AND ROOF FRAMING LAYING OUT FOUNDATIONS
AUDELS CARPENTERS AND BUILDERS GUIDE 4
DOORS WINDOWS STAIR BUILDING MILLWORK PAINTING
AUDELS CARPENTERS AND BUILDERS GUIDES ILLUSTRATED

Inside Trade Information for Carpenters, Builders, Joiners, Building Mechanics and all Woodworkers. These Guides give you the short-cut instructions that you want—including new methods, ideas, solutions, plans, systems and money saving suggestions. An easy progressive course for the apprentice and student. A practical daily helper and Quick Reference for the master worker. Carpenters everywhere are using these Guides as a Helping Hand to Easier Work, Better Work and Better Pay. To get this assistance for yourself, simply fill in and mail the FREE COUPON below.

Inside Trade Information On:

How to use the steel square—How to file and set saws—How to build furniture—How to use a mitre box—How to use the chalk line—How to use rules and scales—How to make joints—Carpenters arithmetic—Solving mensuration problems—Estimating strength of timbers—How to set girders and sills—How to frame houses and roofs—How to estimate costs—How to build houses, barns, garages, bungalows, etc.—How to read and draw plans—Drawing up specifications—How to excavate—How to use settings 12, 13 and 17 on the steel square—How to build hoists and scaffolds—skylights—How to build stairs—How to put on interior trim—How to hang doors—How to lath—lay floors—How to paint

THEO. AUDEL & CO., 49 W. 23rd St., New York City

Mail Audels Carpenters and Builders Guides, 4 vols., on 7 days' free trial. If O.K. I will remit $1 in 7 days, and $1 monthly until $6 is paid. Otherwise I will return them. No obligation unless I am satisfied.

Name.....

Address.....

Occupation.....

Reference.....

HANDEE

TOOL OF 1001 USES

ACTUALLY A WHOLE SHOP FULL OF TOOLS IN ONE

Uses 200 different accessories, instantly interchangeable in easy-working chuck. For faster, better work on all materials, at home, in shop, or take to job. Plugs in any AC or DC socket, 110 volts. You'll be amazed at its unmatched performance, precision and almost human response.

Grinds
Drills
Polishes
Engraves
Sharpens
Carves
Cleans
Sands
Cuts
Saws

STANDARD MODEL

13,000 r.p.m. Weighs 16 oz. $10.75 postpaid with 3 Accessories.

DE LUXE MODEL

25,000 r.p.m. Fastest, smoothest, most powerful tool for its type and weight, 12 oz. $18.50 postpaid with 6 Accessories.

GET A DEMONSTRATION

at Hardware, Tool or Dept. Stores, or let us send either model on 10-days Money-back Trial. Catalog Free.

***New* ROUTER and SHAPER**

Convert your De Luxe Handee into an easy-to-handle Router or Shaper that will inlay, rout, carve, make molding cuts to 100th of an inch accuracy. $12.50.

Chicago Wheel & Mfg. Co., 1101 W. Monroe St., Dept. H, Chicago, Ill.

☐ Send Catalog ☐ Router-Shaper Set M.I.-8
☐ De Luxe Model ☐ Standard Model ☐ Send C.O.D.

Name .....

Address .....

How To Moor The Small Boat

[*Continued from page* 140]

nent mooring. The stake should be cut from a strong sapling and the bark skinned off before it is driven.

The anchor is connected to the boat through the mooring cable. This may be of manila rope, chain, or in some of the more expensive outfits, stainless steel cable. Rope has the advantage of being easy to stow but when it gets old its strength is a doubtful factor and as a mooring cable it should be renewed every season. Chain, if galvanized, is excellent but will sometimes impose quite a strain on the mooring bit of the boat because of its inability to yield to a strain. A combination of half chain and half rope, with the rope having strength equivalent to the chain, is perhaps the best of all mooring cables. The weight of the chain keeps that portion of the cable on bottom so that the boat has to lift it in a seaway thus eliminating any shock on the cable. The chain is at the anchor end where it also takes the wear of the cable dragging on the bottom.

Some means of marking the anchor location must be provided. This device is generally termed the buoy, which may consist of any device that will float. There are three types of buoys in general use, the can, the spar, and the cork float. Most can buoys are manufactured and vary from a ball of metal to a cone. The spar buoys are sticks of wood attached to the anchor cable while the cork float is just what its name implies. These may be constructed of the cork salvaged from several old life preservers and sewed in a canvas bag which will fit tight around the cork. Ropes sewed around the bag as shown form an efficient way of picking it up. The whole assembly should be painted white so that it may be seen at night. When the skipper is ready to cast off his mooring he attaches the float to the eye of the mooring cable and simply heaves it overboard. When ready to pick it up again it is a simple matter to catch either the buoy or mooring eye with a boat hook and haul the cable on board. This eliminates the catching of a messy can or spar all fouled with seagrass and barnacles.

Another type of simple buoy is to use a quarter beer barrel with a bolt run through its bung and out the other side. Care should be taken that the ends of the bolt are made watertight. This type as all other buoys and spars with the exception of the cork are secured to the mooring cable and a separate line is led from them to the boat. For small boats anchored off shore a simple device to anchor the boat is to place a pulley on the anchor and lead an endless line from the anchor to the shore. A tail attached to the endless line is secured to the boat so that it may be hauled in or out at will.

Government scientists are studying a process of seasoning lumber with salt.

Can Amateur Flying Return?

[*Continued from page* 72]

will hop the craft to check its characterists and the day ends with one more amateur plane successfully flying.

In reviewing the activity of the Private Flyers Association, it is noted that the members average around 75 hours of flying each year. From five to twelve planes are built annually. Some ships are crashed, but without serious injury to the pilot.

The success achieved by Oregon and the Private Flyers Association in amateur aviation demonstrates that there is a place for the amateur airplane builder in American aviation. But if the amateur is going to be allowed to continue his work in the majority of states, drastic action must be taken at once. No better step can be taken than in seeing that a code such as that existing in Oregon is incorporated in the laws of *every* state. This can be done if the amateurs will band together. Amateurs in Washington and Utah have already organized and it is probable that these two states will soon allow the amateur the same freedom enjoyed by his friends in Oregon. If eight or ten persons in each state will only be willing to share the time, effort, and expense, an active state organization similar to the Private Flyers Association can easily be formed. Details concerning the organization of such a group may be had by addressing a stamped and addressed envelope to Private Flyers Association, Eugene, Oregon, or to the editors of Mechanix Illustrated.

Pictures From Pigmy Prints

[*Continued from page* 145]

uniform and stronger paper base for photomurals. Sensitized paper is commonly made in rolls 300 feet long, but recently the largest roll yet manufactured was specially produced for one job. It was 750 feet long, and its absolute uniformity of emulsion guarded against variations in tonal values during the printing process. Improved negatives have also contributed to higher quality of artistic finish.

Constantly changing technique has called for new apparatus all down the production line and the business of making photomurals is now well established on a sound technical basis. Photomurals in natural color are, for instance, being discussed as a future achievement.

In the presence of moisture, cracks in concrete heal so tightly that the concrete may be stronger than before.

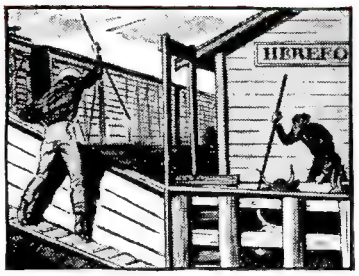
Reserve your September issue of MECHANIX ILLUSTRATED at your news dealer NOW.

BEAM OF LIGHT STOPS DEATH PLUNGE

BILLY KENNON, JR.

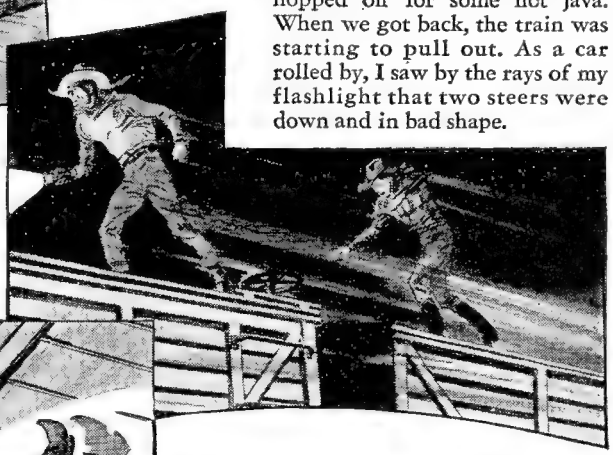
TRAIN THROWS COWBOY FROM ICY CAR TOP

1. "As a cattle shipper for one of the biggest outfits in the Southwest," writes Billy Kennon, Jr., whose address is Box 304, Douglas, Arizona, "it is my job to see that cattle shipments arrive at destination in good shape.



2. "We left Hereford one night with 35 carloads of poor cattle and I had a hunch that meant trouble. At two A.M. we stopped at Gila Bend. It was black as ink, drizzling and very cold. My partner and I hopped off for some hot java. When we got back, the train was starting to pull out. As a car rolled by, I saw by the rays of my flashlight that two steers were down and in bad shape.

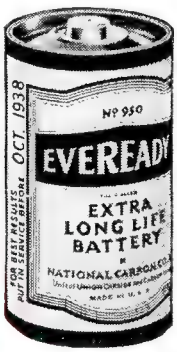
3. "We grabbed at the car and hollered to the brakeman to keep going. I handed my flashlight to my partner, told him to shine it into the car. I had both steers up on their feet a few miles out of town. And though we were making about forty miles an hour by this time, we decided to walk the top back to the caboose.



4. "My partner ahead of me still had my flashlight. Ice was forming on top of the cars and in my high-heeled cowboy boots, it was hard going. I hollered at him to stop. As I did so my feet slipped out from under me...I was headed for my doom.

5. "Down I went between the cars just as my partner swung the light back. It shone on the brake wheel. I made a one-handed grab—and caught it! Thanks to *fresh* DATED 'Eveready' batteries being on the job, I had that split-second chance to save my life! They are life-savers and no fooling!"

(Signed) Billy Kennon Jr.



FRESH BATTERIES LAST LONGER... *Look for the* DATE-LINE

NATIONAL CARBON COMPANY, INC., 30 EAST 42nd STREET, NEW YORK, N. Y.

PRINTED IN U.S.A.

Grace Moore
in Magnolia Gardens
.... Chesterfield time is
pleasure time everywhere

They Satisfy

Copyright 1938, LIGGETT & MYERS TOBACCO CO.

Double Page Spreads

Harness elephants help the engineers solve the muddy-lot problem. They supply the push-pull power.

Quarter-poles go up after the center of the tent has been raised. Then the furniture men move in and have the stands in place by the time the tent is up.

The Big Top is laced together from 18 sections. There are 6½ miles of seaming in the top, and it weighs 21,600 pounds.

thirty-odd big and little tents in the canvas community.

Only by the almost perfect functioning of the component parts of a big circus is it possible to move, set up and take down the mechanical marvel that is "the biggest thing on wheels." Circus engineers devote a lifetime to devising easier and simplier methods of handling the big top, and its operation today is an engineering achievement. As a matter of fact, when the Barnum & Bailey circus was in Europe before the World War, it had reached such a point of systematic excellence that the German Army copied its methods of loading and feeding its people.

What were the circus engineering secrets that a world power considered good enough to copy?

To understand this engineering achievement, let us first consider a case in point: It was a stormy night in the Autumn of 1932. The pole wagon was in to the hubs. A forty-horse hitch, snake-hooked to pull from the front and sides, and two elephants pushing from the rear, finally rescued it from the clutches of the sand as the big show fought to get off the lot in Tallahassee, Fla. The next stand on the route was Jacksonville, 175 miles away. The last of the show's heavy wagons got off the lot 10:30 in the morning and headed for Jacksonville, arriving there by rail at 9 o'clock on the night of exhibition. Five thousand people were on the show grounds; cookhouse and stables were up, but nobody expected that a performance would be given. Those spectators reckoned without the circus tradition, however, for the late John Ringling quietly gave the order that wrote another chapter in the history in the nomadic amusement enterprise that builds a new home in a new town every day.

"Put it up. We'll give a show," Ringling said. And put it up they did. The show went on at 12:30 in the morning, exactly three hours after the last section of the circus arrived on the lot.

With the order to "put it up," the circus engineers began to function. "Frenchy" Haley, the layout man, went to work with his pegs, outlining on the ground a complete diagram for the tent positions. Behind him came the pole-men with their towering poles which they erected with the aid of elephants. Canvasman Jimmy Whalen supervised the stretching of the canvas which had to be laid out and laced together. So closely did each engineering job follow the preceding one that all seemed confusion. But when the outside poles were raised and the quarter poles went into position, the tent began to go up. In a little less than four hours, 275 men, aided by baggage horses and harness elephants, had the tent up, the seats in place, and the show was ready to go on.

Several definite milestones in the rocky path of circus history contributed to the fact that it is possible to transport the big show on schedule, erect its billowing big tops under handicaps of rain, mud, wind and sand, present its performances and load out again in a seemingly endles cycle. The show was put on rails in the early seventies. This revolutionized circus business, making it possible to play wide areas on absolute schedule. When Ringling Bros. combined their circus with the Barnum & Bailey show after the World War, they put their enterprise on 100 railroad cars. Obviously it had to move in units. Today, there are four trains comprising the big show's rolling stock, and within the past decade the flat cars which carry the wagons and cages are 12 feet longer than the 60-foot length of the average flat car. The first circus railroad train carries the cookhouse equipment, the stable tents and numerous baggage horses, as well as the wild animal menagerie. This train usually leaves town before the night performance is over and it has its tents in the air in time for breakfast, when the remainder of the show arrives in the next stand. The second section carries the sideshow and the countless props necessary to the presentation of the main circus performance; the third is a veritable "lumber train," transporting the seats, grandstands and attendant equipment, while the last railroad train brings in the performing personnel and also what is termed "lead stock"—

Quarter-poles ready for use. They support the tent over the seats and are inspected for flaws regularly.

Altogether, the circus engineers put up more than 30 tents. The picture shows a few of the smaller ones.

Circus engineers designed this wagon specially for Gargantua (below). It is glass enclosed and air-conditioned. Interior lights are sunk in the floor. Frank Buck is at the "mike."

animals such as elephants, camels, zebras and performing horses that can be led from the railroad runs to the show grounds. All the sections have sleeping cars for the people who accompany them.

Traveling in four sections would not, however, make possible the engineering triumph of the circus without the supplementary acquisition of various mechanical devices to facilitate the speedy erection of the tented domain. In 1903, when the Barnum & Bailey Circus returned from Europe, bringing with it the European idea that involved the erection of box seats around the hippodrome track, circus engineers went to work with the express purpose of rebuilding the circus along more mobile lines. "Happy Jack" Snellen, who was without any doubt the "Thomas A. Edison" of the big tops, for he more than anyone else was responsible for the mechanical ideas that today immeasurably help to "get it up and keep it up," invented the grandstand to replace the "Bible-back" reserved seats used prior to the practical introduction of individual chairs for circus patrons. He devised the mechanical stake driver that puts down two big wooden stakes at one time after the principle of a pile-driver. He invented the stake puller; the "jokes" on the ends of the seat "stringers" or underframes to hold three more tiers on the grandstand. The critics of this particular development in grandstand perfection looked at Snellen's invention and said "It's a joke," and the name stuck. Similarly, the "funny rope," which he devised to facilitate the quick guying-out of the big tent in the face of a sudden windstorm, somewhat after the principle of the old-fashioned snare drum's leather pulls, got its name when the canvasmen looked and said, "What's dat dere funny rope doin' 'round de big top?"

This circus genius in 1913 put eaves on the tents, an 18-inch lip between the side poles and the outer rim of the tent top, to keep rain from dripping onto the spectators in the top rows of the grandstand. He fashioned a special kind of leather-bound grommets for the quarter-pole holes. Another circus inventor, Bill Curtis, once built a huge "spool wagon" that carried an enormous drum around which canvas could be wound. This was intended to supplant the practice of folding it up in sections and loading it flat. The "spool wagon" had one advantage: it saved labor during the war days when manpower was scarce with the circus, but it later was discarded as impractical because it was hard on the canvas itself and could not function as quickly as a full crew of men assisted by the newest loading invention, the canvas "loader." This device employs the crane principle to lift and load the heavy bundles of canvas after they have been rolled up by the roustabouts. This wagon unloads, too, and its operations save several valuable minutes both in the erection and in the striking of the show.

The big tent is new every year, and the tent of the previous season is carried for any emergency that might arise. This "second" tent is discarded in its third season, when it is replaced by last year's big top, and its hardware salvaged.

Circus center poles are of northern fir, specially shaped and treated. The big top canvas is spread out on the ground in sections like a giant's shirt, assuming, however, an exact oval pattern, and the 18 sections laced together through 2,088 steel rings. After canvasmen have pushed up the side-wall poles (112 of them) around the outer rim of the big top, a block-and-tackle system handled by men, horses and occasionally by harness elephants hoists the peaks to the center poles which already are in the air and guyed out.

The quarter-poles that support the canvas stretching from center poles to sidewall then are inserted in their grommets and pushed aloft by men and by teams of horses. At this point, the big top is "in the air" and the baggage wagons can move in with their rigging, seats, ringbanks, stages and similar equipment. Putting up the seats and the rigging requires more time than is necessary for the actual erection of the mammoth tent. The rigging such as is used by aerial acts must be put up with extreme care by Mickey Graves and his property men, for the lives of the performers depend on it.

The lot superintendent is Edward Kelley, and it is his job to see that all working departments of the physical show function quickly and properly. The layout crew mark off the lot with tape measure and tiny iron pegs tipped with flags so that the stake drivers will know exactly where to drive their stakes. Then the canvasmen go to work under the supervision of James Whalen, who is seventy-seven years of age and who has been "putting it up and keeping it up" since 1881.

While the principal means of transporting wagons from railroad runs to show grounds and back again involves the use of 300 baggage horses which do not share the spotlight with their performing cousins, the show uses a fleet of motor trucks to haul trailer-fashion some of the lighter wagons and thus to speed up the movement of the show from the runs to the show grounds. The heaviest wagons require four, six and eight-horse hitches. Heaviest wagon on the show is the one that carries the blue quarter-poles. It weighs about 14 tons and nobody with the circus calls it the pole wagon. It's the "smoke wagon" and its nickname has come down through the years from the day when a circus boss shouted to some loafing roustabouts who

[*Continued on page* 135]

The mighty smithy retains a place of importance in the circus setup. Six portable forges are toted along; repairs are made on the lot.

300 performance horses are used in the circus' stunt repertoire. Clearing this car with a rider standing astride the backs of two horses is just a bowl of cherries for horses and rider.

10,000 Miles an Hour!

Rocket flights of tomorrow will circle the earth in 3 hours—maybe.

by Allan Finn

At 2¾ miles a second, a rocket of tomorrow will describe a parabola at 600 miles, its power will be shut off and the rocket will coast to earth!

Recent tests at Pawling, N. Y., showed promise. A roar and a cloud from the exhaust—and the rocket streaks skyward at 700 m.p.h.

Winter (above) and summer (left) found rocketeers testing their creations. Note tail design and different shapes.

WALK past almost any flowered field or meadow from Connecticut to California these fine summer afternoons and as likely as not you'll see little knots of agitated men puttering with strange-looking contraptions which hiss and let off gaseous odors. Edge over to satisfy your curiosity and some of them will come running up warningly to shoo you away.

There's a good reason for the presence of so many mysterious looking men. Rocketry is making tremendous strides in its development as an embryonic science. Over the past winter there have been many important developments in cellar and garret workshops everywhere. Under the clear skies of July and August tests are being made to ascertain their practical value.

For one thing, a dozen new motors—combustion chambers with their flame-emitting nozzles—are undergoing trials. Tests now in progress have definitely passed rocketry from the hobby to the engineering stage. Its rule of thumb days are over, its votaries the aerial giants of tomorrow.

In this transition the two basic problems of the science have been conquered, to-wit: how to use and control explosive and volatile fuels and how to burn them properly to gain the necessary thrust or recoil in take-offs. This procedure is facilitated by the fact that the fuels now used—oxygen and gasoline mixture or oxygen and alcohol—are not in themselves explosive. They are easy to feed to the combustion chamber, too. Liquid oxygen is automatically forced from its tank into the burning compartment by the pressure of its own evaporation.

Gasoline or alcohol is pressed inside by compressed carbon dioxide or nitrogen. Flow

of the intermingling fuels also is controlled by valves.

Moreover, rocket men have developed motors with sufficient thermal efficiency—about 10 per cent—for present experimental shooting requirements. In addition a number of smaller problems relating to dynamics and aerodynamics have been solved or nearly solved.

Armed with these substantial achievements experimenters confidently believe that rocket flights of 25 miles are close at hand, flights of 100 miles around the corner and flights across the Atlantic a definite possibility within our lifetime. More, they believe there is plenty of theoretical basis and some evidence for the conviction that given enough money, power, experimental data, they could shoot their devices to the moon.

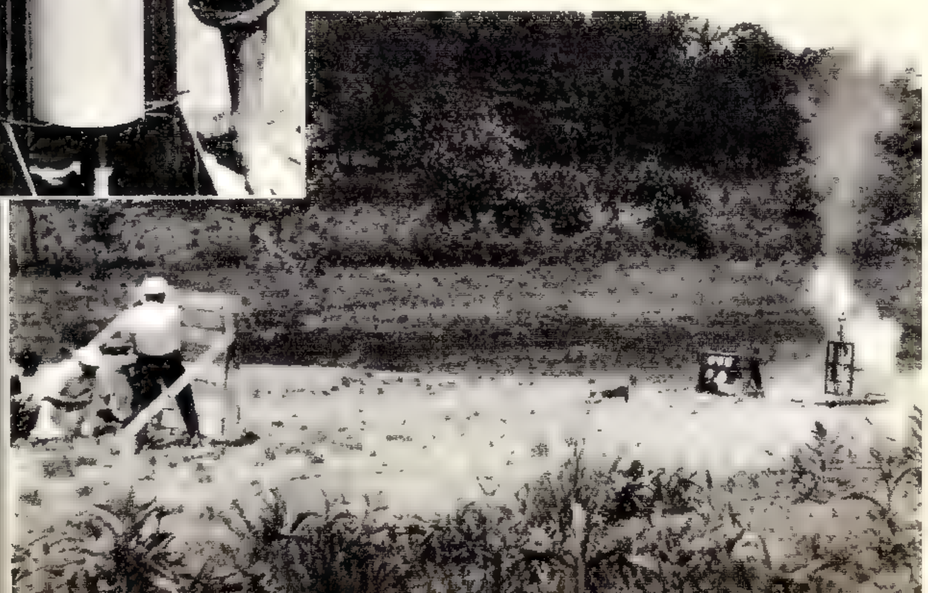
Although such flights at present are only in the realm of speculation, rocket ships for them have been designed and the problems of their propulsion and navigation worked out on paper. Ocean-flying rockets would be shaped like a needle, hermetically sealed and steered with gyroscopic fins. Of several compartments, the front of the rocket would be occupied by passengers and crew. Abaft of them would be the fuel tanks, the motor, gyroscope and parachute for descending.

Loaded and ready for a flight, say from Long Island to London, the Atlantic rocket would be assisted in its takeoff by some auxiliary. It might be pushed by a powerful locomotive on a sloping rail, catapulted by a titanic wheel or hurled from a cannon's maw after the fashion of Jules Verne's projectile.

Once in the air, the rocket would soar through the stratosphere at an estimated maximum of 10,000 miles an hour, about 2¾ miles a second. After describing a parabola at 600 miles, its power would be shut off—by cutting the fuel tanks—and the rocket would coast to its destination. A few miles before landing a parachute released from the rear would check the terrific speed. Thus controlled, the ship would slide to a rest on a wheeled car in a long runway!

Such a flight, it is estimated, would be made in 50 minutes!

Compared with these ambitions actual accomplishments in the air no doubt have been small. Yet they have been no less substantial. Mail, for instance, has been shot over the mountains near Graz in Austria. A live rooster has been catapulted in a rocket over a river in India. There have been rocket glider flights in Germany; test flights of rocket-propelled pilotless planes at Greenwood Lake, N. Y.



Above: Rocketmen carefully check their machines with a battery of meters and test combustion (as shown at left) before a flight. Note the testing panel and men crouching behind protecting wall. Rocketman G. E. Pendray (above center) supervises rocket experiments.

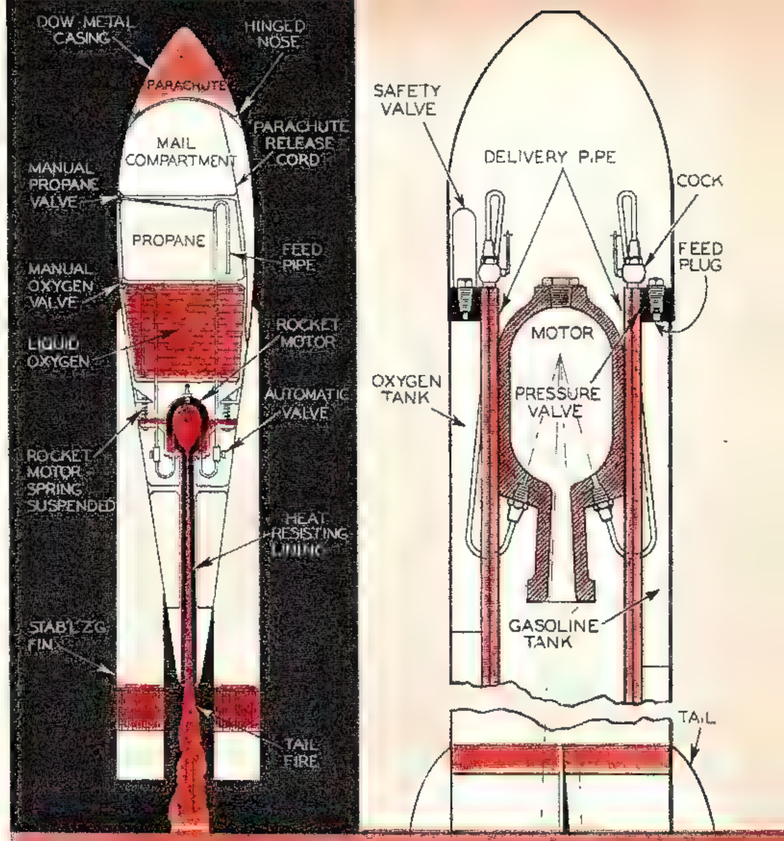
Dozens of dry and liquid fuel rockets, of course, have been sent up with varying success. At present the altitude record for a rocket stands at 7,500 feet. It is credited to Dr. Robert H. Goddard, dean of rocket experimenters. He set it at his laboratory near Roswell, New Mexico, in May, 1935. Doctor Goddard's rocket attained a speed of 700 miles an hour.

Dr. Goddard launches his rockets from a 60-foot rack. The rockets are about 12 feet long, 9 inches in diameter, weigh from 30 to 80 pounds. The actual motor is about 5¾ inches in diameter and weighs about five pounds. Fueled by gasoline and oxygen, these rockets are steered by a delicate gyroscope whose spinning wheels, affected by any change in direction, control vanes guiding the course of the exhaust flames.

Firing, which Colonel Charles Lindbergh, a rocket enthusiast, has witnessed as Doctor Goddard's guest, is simple. The fueled rocket is put on the rack and ignited by a fuse set off electrically from a telegraph key. A blast of white flame issues from the nozzle, and with a terrifying swish the rocket slowly rises from the tower. In a flash it is zooming like a thousand hissing vipers in the sky. The rocket undulates from side to side as the gyro continually corrects its skyward course. On one flight, Doctor Goddard reported, the rocket reminded him of a fish swimming in a vertical direction.

Doctor Goddard has developed motors of sufficient strength to resist the effects of constant firing and he believes he has the stabilizer problem licked. Currently, he is working on weight reduction of his rockets.

As recognition of the public's inquiring mind, the New York World's Fair has prepared a transportation unit with a hypothetical rocket car.



Above left: Cross-section of a designer's conception of a mail rocket showing mail compartment, parachute and rocket motor. Above right: Cross-section showing details of the motor. Below: The start of a rocket flight. Note tower and shape of rocket. Such tests presage flights of tomorrow.

In Germany it is reported the military scientists there have developed a rocket cannon capable of shooting a thousand miles.

The United States Weather Bureau in Washington has been keenly watching developments. It has agreed when rocket men are ready, to allow them the use of delicate

[*Continued on page* 139]

GIANT Pictures From Pigmy Prints

by H. H. Slawson

Huge pictures from tiny negatives have set a new style in interior decoration. A woman's whim started it.

LIKE all big things that have a small beginning, the making of giant photomurals was just a little idea back in 1927, when Mrs. C. B. Goodspeed of Chicago walked into the photo studio of Kaufmann & Fabry. She carried with her a 4x5 negative of India's famed Taj Mahal and explained to the skeptical Messrs. Kaufmann & Fabry that her idea was to have a picture large enough to cover the entire wall of an alcove in her home.

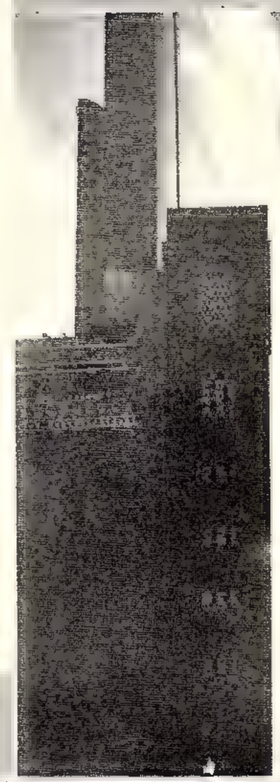
"We told her at once," said Arthur E. Clason, the veteran photographer who eventually completed the job, "that a picture the size she wanted had never been made before. Enlargements, as known today, were unheard of. The widest paper available was only forty inches, so three strips would be required to cover her eight-foot alcove. We were not sure printing could be controlled so that tonal values of these strips would be identical. We feared, too, that due to inability to hold the paper absolutely flat during printing, the curled edge would distort the image. Our big worry, though, was that the dampened paper would stretch without uniformity. There was also the possibility that, due to improper development, the emulsion on the negative would show a blotched or 'grainy' appearance when enlarged to the unusual size, thus destroying the artistic tone of the finished picture."

Mrs. Goodspeed departed but did not give up. And finally, when the studio consented to project the negative, it was found to everyone's surprise that it had been correctly exposed and developed. Even when enlarged to twenty-five diameters on the screen, the superior quality of the negative nullified all opposition to the undertaking. After that showing the studio was compelled to accept her order.

"We realized that we were attempting something without knowing the rules, but there was nothing hit or miss about our procedure. Every step was carefully plotted out and our subsequent operations have closely followed that first experience. When the strips were eventually joined on the alcove wall, the images matched within less than a quarter of an inch.

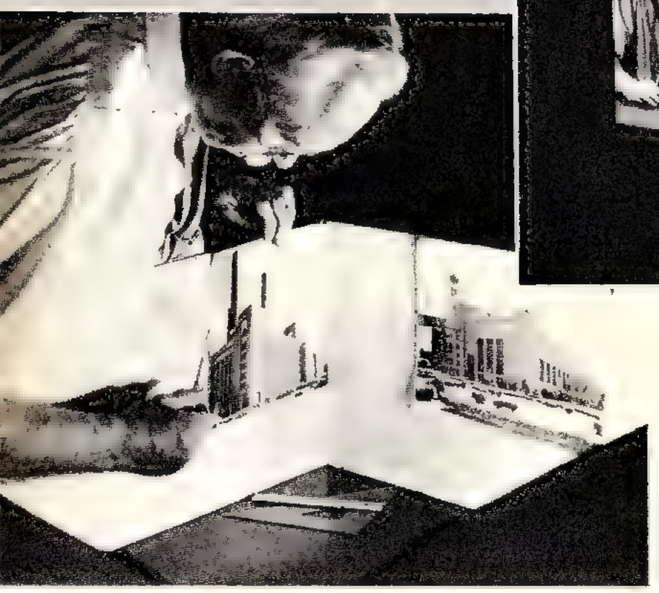
"Mrs. Goodspeed provided the paperhanger, but we furnished paste, just to be

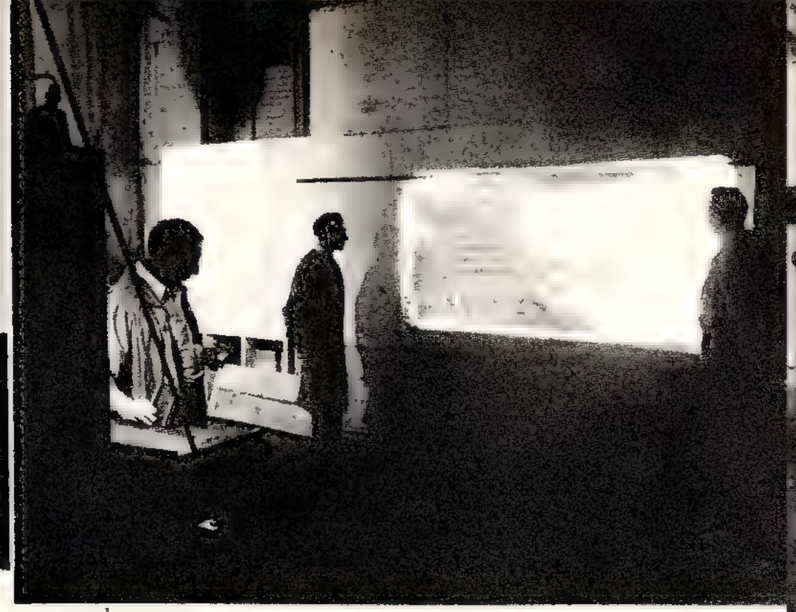
Below—Taj Mahal, famed temple of India, was Kaufmann & Fabry's first giant mural. Left—The giant Ford mural is 600 feet long, 20 feet high.



Below—Photomurals made the artistry of this room possible. Right—Final retouching is done on the enlargements themselves. Note the contrast in size between man and picture.

Below—A scale model of the room is first designed to study decorative possibilities. Right—Photographic paper is tacked on a wall and the negative image projected on it.





Left—After development, the photographic paper is carefully washed in steel tanks each holding 400 gallons of filtered water and accommodating a print 25 feet long. Left—After thorough washing, the prints are lifted on special holders and placed on the drying racks. Below—The finished job projected by the designer on the scale model on the opposite page is shown here in the office of the plant in the photomural.

sure he did not use anything injurious to the emulsion. The paper was applied direct to the plaster, which, as learned from later experience, might have brought disaster. This first job was saved, however, because Mrs. Goodspeed had asked for a 'gold tone' finish and $50 worth of pure gold bullion was used to produce it. Between that gold coating and the lime no chemical action occurred and today, after nearly twelve years, the world's first photomural still hangs there in all its original bright perfection."

It was not until three years later, in 1930, that the commercial possibilities of photomurals was realized by Kaufmann & Fabry, when they were asked to decorate the walls of a Chicago night club's reception room. Here, after preliminary consideration, a drawing, 6x20 inches in size, the work of the artist, Aaron Douglas, was enlarged to fill every inch of wall space in a room measuring 51x20 feet.

The accomplishment attracted widespread attention and discussion in art circles. Interior decorators began placing orders and then came Chicago's Century of Progress Exposition, which, as Mr. Clason remarked, was "practically baptised with a photomural."

H. M. Pettit, the artist who specializes in bird's eye drawings, had made a picture visualizing how the fair would look when completed and the exposition's president, Rufus Dawes, thought it would make a fine ornament for the administration building's reception room, "if it could be enlarged a bit." So Kaufmann & Fabry enlarged it quite a bit. Pettit's picture was 26x40 inches in size and the completed photomural was 20 feet, 6 inches high by 35 feet long.

"It was our first real 'whale,'" remarked Mr. Clason, "and gave us our first experience in excessive height and multiple sections. The first photomural had been made in three sections, but since our projector could only throw images about ten feet long, this fair job required thirty-three sections. Today, incidentally, sections twenty-four feet long can be printed without difficulty.

"Those thirty-three sections had to be uniform in tonal values. But variations in strength of light, temperature of developer and a half dozen other factors might combine to cause slips that could not be corrected once we had started. During hanging, expansion, both horizontal and vertical, had to be watched and at the same time moisture content of each section when applied to the wall, must be approximately equal to that in the sections to which it was joined. I stayed on that job like a hawk."

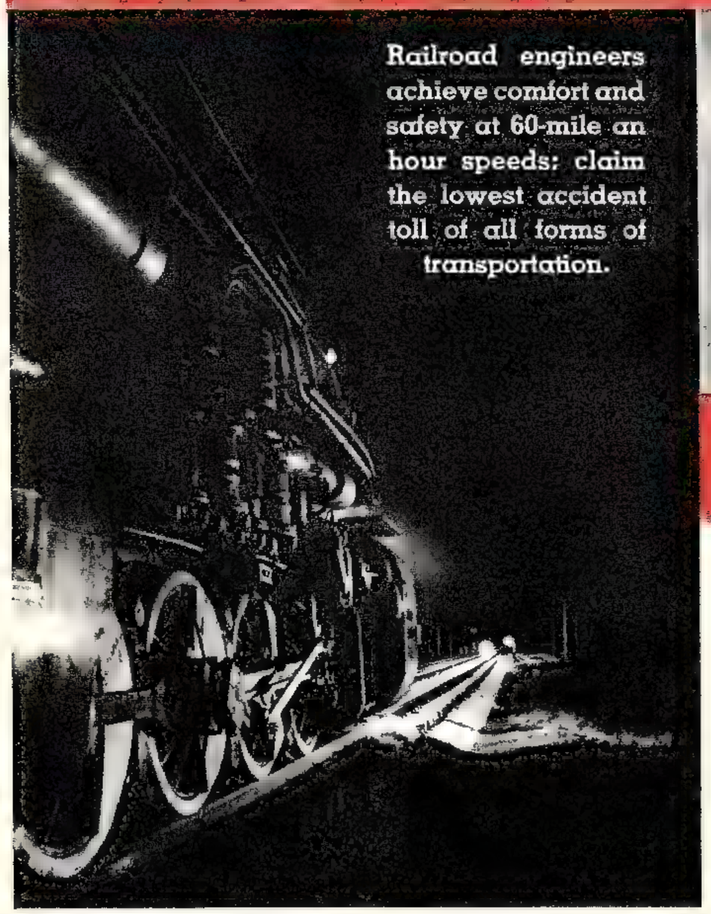
This installation introduced the world to the possibilities of mammoth photographs as a new form of wall decoration. After seeing it, fifty exhibitors placed orders for giant pictures for their 1933 exhibits. Next year this number increased and meanwhile other studios had also begun to produce the new style pictures.

It was for the 1934 fair that Kaufmann & Fabry made the world's largest photomural for use by the Ford Motor Company. It approximates 600 feet long and twenty feet high and is composed of ninety-eight steel-framed panels. Subjects are scenes around the company's plant, made from negatives 4x5 or 8x10 inches in size. Nearly one mile of photographic paper, forty inches wide, was required, together with 12,000 feet of plywood for backing, 200 gallons of paste, half a mile of chromium metal moulding and other materials in proportion. The big picture now hangs permanently in the Ford "Courtesy Building" at Dearborn.

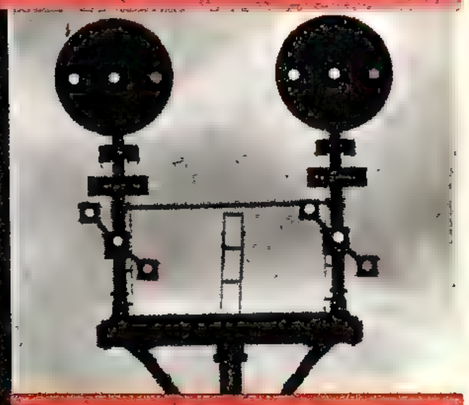
Photomurals are now employed for wall decoration and other purposes in an infinite number of situations. Some twenty distinct types have been created, ranging from the

[*Continued on page* 137]

MILE-A-MINUTE



Railroad engineers achieve comfort and safety at 60-mile an hour speeds; claim the lowest accident toll of all forms of transportation.



An elaborate safety signal system visible day and night warns the engineer of possible traffic hazards along his route.

I'M SUPERSTITIOUS, see. It's Friday the 13th. I broke a mirror this morning, and the minute I stepped outdoors a black cat crossed my path.

Naturally, with things against me like that, I've got to play it safe. Do I go back and lock myself in the house? Do I tuck me away in my own little bed? Nothing of the sort! This jinx business is serious and I've got to get the percentage on my side. So I buy me a ticket on a nice fast railroad train.

If that sounds screwy to you, just look at accident figures for 1936:

	DEATHS
Accidents in the home	38,500
Automobile accidents	37,800
Public accidents (not due to autos)	20,000
Occupational accidents	18,000
Passengers killed, steam trains	23

So you see why I'm going to ride me a train. Perhaps I'll pick out one on the B. & O. Not a passenger has been killed on that line since 1919.

The greatest danger in the operation of all high speed vehicles is that of collision, and this danger the railroads have tackled from the earliest days. Now, with modern signal equipment, collisions are a rarity indeed.

Ride with me, if you will, in the locomotive cab of the New York Central's crack "Wolverine" from New York to Albany, and I'll show you how these signals work to prevent disaster.

Business is good today, the Friday before a week-end holiday—so good that the train must be run in three sections, as close together as safety will permit. We're with Engineer Simons, who has the third section. We're electric to Harmon, and steam the rest of the trip.

We leave Grand Central Terminal during the evening rush hour—a sixty-minute period during which 200 trains will use the 78 terminal tracks, and the four-track bottleneck tunnel under Park Avenue.

The first two sections have pulled out. We get a clear signal almost immediately, and start to follow. Our terminal track is at the

SAFETY

by Robert W. Gordon

extreme left of the upper level, and we are to take the inside right track through the tunnel, which means that we must thread our way diagonally across the entire maze of tracks. Levermen in the interlocking towers have set up that route for us, and the signals are all clear.

But a train coming down the outside left track is due to be spotted on one of the terminal tracks to the right. In the rush of work, the levermen in the tower forget about us and route that incoming train directly across our path.

Here is the stuff that collisions are made of!

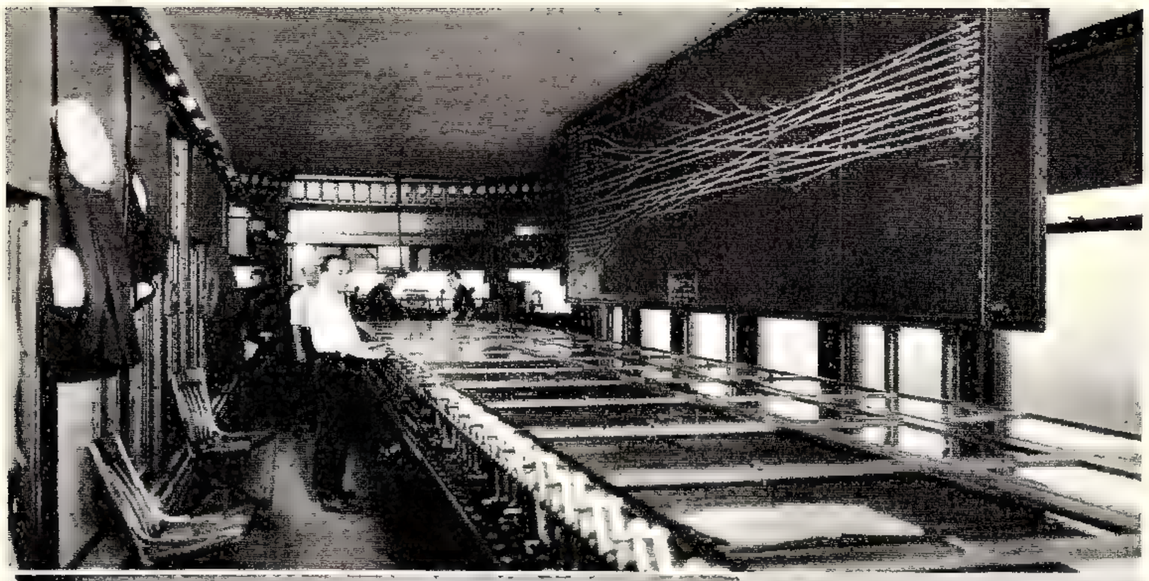
But nothing happens. That incoming train simply waits until we are clear. All switches and signals in the terminal are controlled through an interlocking plant, which makes it absolutely impossible to set up conflicting routes. A train cannot move until a clear route has been established. Once the route is set up, it must be cleared before other switches and signals crossing or touching that route can be changed. The element of human error has been completely eliminated.

But suppose something goes wrong mechanically? No machine is perfect.

The modern train is designed for comfort. The hostess on the Chicago, Rock Island and Pacific helps make the ride pleasant for passengers.

When something goes wrong with an interlocking machine, traffic simply stops. If a locking dog gets stuck, it still locks conflicting levers. If a switch doesn't close, it is impossible to set a clear signal across that switch. If a signal light burns out, so the indication cannot be read, engineers must consider it a danger signal and stop.

We're clear of the terminal now, and are running through the tunnel, which is gov-



Left—This shows the director's desk in the interlocking tower of the Washington, D. C. terminal. Dials above repeat signals in the yard outside. Above: Showing track control panel of the terminal.

erned by automatic block signals. These tunnel tracks are signalled both ways, meaning that trains can be run over them in either direction.

The director of the interlocking tower ahead of us at Mott Haven has two incoming trains to send into the terminal. He decides to route one of them down the track on which we are moving. He tries to move the traffic lever which will change the direction of the signals, but that lever won't budge until we have cleared the track, and without changing the direction of traffic with that lever, he cannot set the switch and signal levers that will put a train on our track. We couldn't have a head-on collision here, even if a signalman went berserk and tried to wreck us.

We change to a steam locomotive at Harmon. Soon it gets dark, but we continue to speed up the winding tracks along the Hudson at 70 miles an hour, about three miles behind the second section.

A mischievous boy with a .22 rifle decides to have a bit of target practice, so he shoots out the roundels of a semaphore signal after the first section has passed. The second section barges around a turn, and where a signal light should be, all is dark. The engineer immediately closes his throttle and releases the air. His train grinds to a stop.

We are right behind. Will we plow into him before the flagman can get back to wave us down with lantern and flares?

No, our engineer and fireman have been calling signals as they come into view. Now, instead of "High Green," which indicates a clear track, the fireman sees a yellow light over a red, and calls "Approach Medium."

"Approach Medium," the engineer repeats, and closes his throttle. He doesn't know the train ahead has stopped, but the signal has warned him that he is getting too close to it.

The next signal shows a yellow light over a red—the "approach" indication, meaning "be prepared to stop at the next signal." Long

Top—Overhead signals control movement of trains over a bewildering maze of tracks and switches. Above—Repairmen check the rails; insure safety.

before we round the turn and see the flagman's warning, we are running slow enough to stop within a few feet.

That warning we got three miles back was entirely automatic. A single volt from a storage or caustic soda battery flows through the track continuously when that track is clear, but when a train enters the block, the circuit is shorted. The magnetic latch, which has been holding the semaphore in the vertical position, lets go, and the signal behind the train falls to the "stop" position. Sensitive relays then change the two signals behind to the proper cautionary indications.

We have a three-block semaphore system here. Other roads might use a one or two-block system, depending upon individual traffic requirements. Or color lights, position lights, or color position lights might be used instead of semaphores, but the principle of action is the same—the track carries a current of small voltage. When anything—a train, a broken rail, a mechanical failure, interrupts that circuit, the signals say "Stop," or say nothing at all, which means the same thing.

But suppose that our engineer and fireman both missed that first danger signal. Through magnetic induction, a relay is opened in the cab and a warning whistle is blown. The engineer then has fifteen seconds in which to press the acknowledging lever and begin slowing his train. If he doesn't act within that time, the brakes are automatically applied.

All railroads do not have this automatic train control, while some have indicators in the cab which repeat the wayside signals. Density of traffic is usually the factor governing such installations; block signals, interlocking, and automatic train control being obviously unnecessary on branch lines carrying but one train a day.

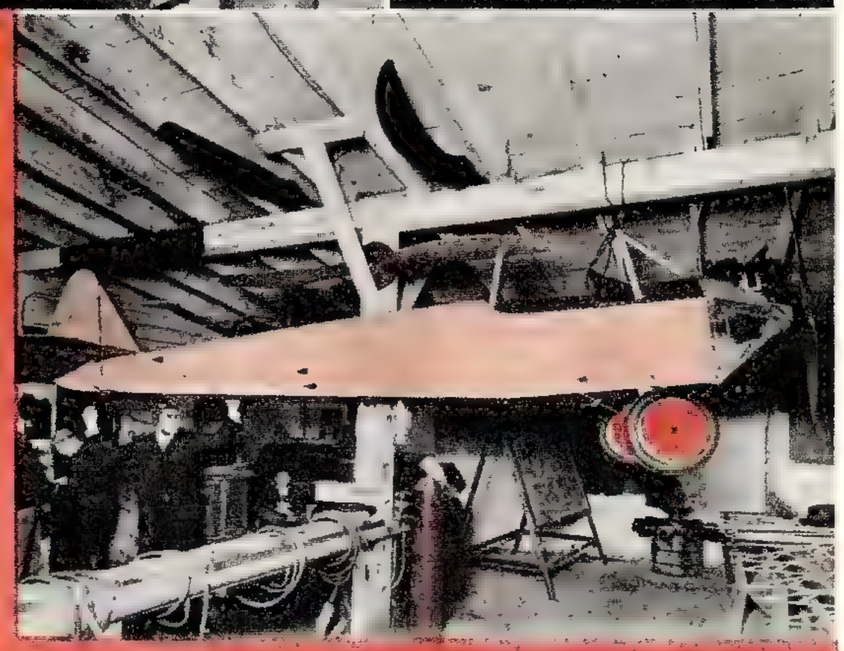
But you could always run off the road!

Certainly. And trains occasionally are derailed. But though railroad schedules have

Can Amateur Flying Come Back?

Above left: 1935 Oregon altitude winner, 11,000 ft. in 27 minutes; 40 h.p. engine. Built by Elmer Smith. Above right: Heath monoplane, 40 h.p. engine, 107 m.p.h., built by Sterling Barnes. Right: Three planes constructed by Oregon flying club members.

Above: Heath monoplane built by Walt Rupert. Left: Wing ribs are carefully inspected. Below: Partially assembled plane.



by Lt. R. H. Rankin

Amateur flying never left Oregon, where it flourished under favorable state laws. States with restrictive laws should go West to see how it is done. Amateurs interested in promoting favorable flying laws in their states should write to the editors for information.

WHETHER or not amateur flying can come back depends on what the friends of flying will do for it in their home states. Although American military and commercial aviation are constantly reaching new heights, the plight of the amateur flyer steadily becomes worse. At the present time, it is practically impossible for the "little fellow," the chap who builds and pilots his own ship, to get into the flying game. Absurd state and Federal legislation has so modified and hampered the home-builder that unless something is done very soon, amateur aviation will be as dead as the proverbial duck.

The one outstanding exception to this situation is the state of Oregon. Convinced that the amateur has certain rights and liberties, this state has aviation legislation which might well be copied by the rest of the states of the Union where restrictive measures exist.

Much of the success of amateur activity in Oregon is due to an organization of amateur builders and pilots known as the Private Flyers Association. The champion of the "little fellow," this organization was formed in 1935 for the "advancement of unrestricted private flying, experimentation, and aviation in general." Almost every person in Oregon interested in amateur flying is a member, as are numbers of home-builders in various other states. Such an association provides for concerted action on any measure and its will cannot be easily disregarded. In event oppressive legislation threatens the amateur, this organization gets busy and sufficient pressure is brought to bear to the end that the state is a haven for amateur plane builders. The membership dues in the Private Flyers Association are not high and a special legal fund is maintained by voluntary contribution to combat adverse legislation.

Realizing that there must be a definite program if amateur activities are to be kept unrestricted, the Private Flyers Association has drawn up a practical code as follows:

1. Appointment, by the governor, of a board of five members, all of them actively interested in aviation, and at least two of them private owner-pilots. Board members to serve five years with a new member being appointed each year. One member to be selected as state aeronautic inspector, to be charged with licensing and registration of aircraft. All members to serve without pay, except for expenses.

2. All students and pilots in the state to be licensed by either the Department of Commerce or the state, the state license fee to be $3 for the year and the state requirements to be modeled on the Department of Commerce regulations, *save for physical requirements.*

3. All aircraft to be registered with the state board. Planes may be either Department of Commerce licensed or, in case of identified aircraft, licensed by the state after being found airworthy. License fee for identified planes to be $5 per year.

4. Aircraft licensed by the state must pass an examination by a licensed airplane mechanic as to general mechanical condition, the charge for this examination to be set by the examining mechanic.

5. State-licensed aircraft to be used for sport, pleasure, or experimental flying only. Commercial flying to be forbidden in such craft.

6. Enforcement of the provisions of the state code to be in the hands of the state police and expenses of the aeronautical board to be borne by the state traffic department.

7. Violation of state laws to be punishable by a fine of not less than $50, nor more than $500, or imprisonment of not less than 10 days, nor more than one year.

Airplanes must be inspected during construction and upon completion and if they pass flight tests to the satisfaction of state inspectors, they are licensed. A $10 fee is charged for the license and $5 for a pilot's ticket of which there are two grades: Private and Student. In addition to these licenses, a special solo ticket is issued on presentation of an affidavit indicating that the applicant has had at least five hours of solo flying. So safe has this regulation worked that in 17 years that the Oregon board has

Nature Photography Around The Year

by Percy A. Morris

Milkweed blossoms photograph well at 1/10 sec. at f.16 on ortho film with fair sun.

MID-SUMMER is apt to be one of the busiest seasons of the nature photographer's year. Flowers are in abundance. Insects are fast attaining the peak of their abundance, and young, half-grown birds, not nearly as shy as their parents, may be seen in every orchard. In fact, in mid-summer it is not so much a question of "what to take" as "what not to take."

When photographing plants, a common difficulty is due to the fact that flowers sway in the slightest breeze, and since flower photography sometimes means time exposures, the photographer has to take advantage of the rare, and usually quite, brief periods during which the plants are not set in motion by the wind. Such periods are more likely to occur during the early morning than at any other time. If the plant is covered with dew, shake it, and then wait several minutes for the various parts to get back into place.

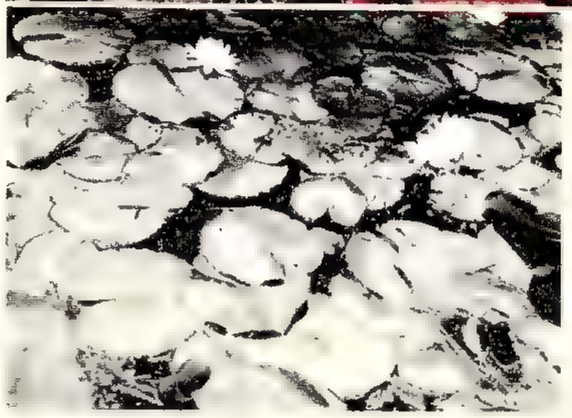
Many successful workers use the "split-exposure" method. The camera is firmly attached to a tripod and critically focused on the flower. The lens is stopped down to its smallest opening, and the shutter set on "bulb." The photographer then waits patiently for a brief interval when the plant is motionless. The shutter is then opened, and closed the instant the plant starts to move. If the exposure time is not deemed sufficient, the photographer merely waits for the next calm moment and opens the shutter again, repeating the procedure perhaps two or three times, until his film has had the proper amount of exposure.

In making a collection of photographs of flowering plants, don't lose sight of the fact that the blossoms are followed by the fruit, in the form either of berries or of seed-pods. Pictures of this phase of plant life are needed if a series is to be made, especially if you are photographing plants from a botanical standpoint.

Snakes make excellent photographic subjects. The snake is a natural-born "poser." When freshly discovered, its first effort is to escape, but if its retreat is cut off, it will invariably assume an attitude of watchful waiting and will "freeze" in this position, holding it for several minutes without so much as a quiver, except for the darting tongue. This permits the photographer to stop down to the smallest aperture to ensure depths of focus, put on a filter, and expose for several seconds if necessary.

Ribbon snake. Easy to photograph, beautiful to look at!

Garter snake. Try this in a bright sun at ½ sec. at f.22.



Pond lilies. Bright sun, 1/50 sec. at f.11 on ortho film.

There is much to commend the snakes to the nature-lover-with-a-camera. The infinite variety of postures they are capable of getting into, all of them perfectly natural and pleasing to the eye; the beautiful iridescent colors of some species, and the fact that a good series of snake negatives are not common.

By far the majority of snakes may be photographed without danger. Some of them will bite if handled, but so will almost any wild creature, such as a squirrel, and of the two the squirrel will give you much the worse nip. It is usually easy to maneuver a snake into position for a photograph without touching it, unless it be with a stick.

A photographer working alone should never attempt to photograph a copperhead or rattlesnake. If two are working together, there is no particular danger, as one can watch the snake while the other is adjusting the diaphragm, setting the shutter, etc. The solitary photographer would have to take his eyes off the snake, and this is dangerous.

MI'S "BOOK OF THE MONTH"

Every month several meritorious books are published which the editors believe are of special interest to readers of MECHANIX ILLUSTRATED. We know, of course, that you may not be able to read them all, and for that reason we plan to select the outstanding book of the month and present here an extract from it. The books will be chosen for their special interest in the fields of adventure, travel, sports, science, mechanics and history. The episodes selected will be of some complete dramatic, informative incident.

Readers who wish to obtain these books to be read in their entirety may order them from local book dealers or by mail from the publishers. Every volume from which we will select an extract will form a lasting, worthwhile addition to your library.

"Nature Photography Around the Year" by Percy A. Morris, is our selection for August. The publisher is D. Appleton-Century Co., 35 W. 32 St., New York, N. Y. Price is $4.00.

HOW PLAIN IS YOUR HOUSE NUMBER

THE boys who drive the delivery trucks for any large department store will tell you that one of their pet peeves is illegible or entirely missing house numbers. Of course bill collectors seem to have no trouble finding the right place, but that is another story.

Nine out of ten house numbers are of the conventional metal type obtainable at any hardware or variety store. These are all right so long as they are in plain sight and properly placed on the house or porch with the necessary contrast between number and background so that a stranger in the neighborhood can read them easily. By contrast is meant black on yellow, gray on red, green on white, or any of the numerous combinations which are possible and at the same time maintain color harmony.

Good looking, appropriate house numbers can be provided in such a vast variety of styles and combinations that this often can be the first practical project for the man who newly acquires a home basement shop. In fact, more than one enterprising chap with a good eye for design, some spare time on his hands and a few tools in his shop, has made a good profit by selling house numbers in his neighborhood. Both metal and wood are ideal materials to work. Especially is it true that hand wrought numbers, designed and executed for a particular home, can bring fancy prices.

Perhaps the simplest number of all is made with a stencil. Oiled cardboard or special stencil paper, is used. The number is laid out in pencil then cut through with a razor blade or jig saw, this held over the surface

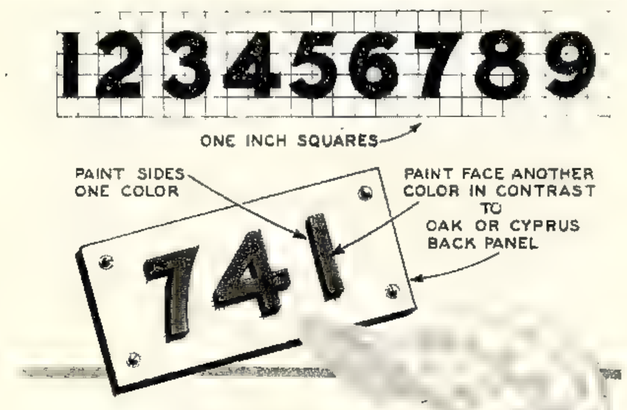
to take the stencil and the numbering done with a stub brush dipped in paint or enamel of the right color. A circular hole is cut in a sheet of heavy paper and held against the step and the exposed portion painted white. Then after the paint dries, the number stencil was held over this and painted in. The effect can be reversed by painting the rectangular area black and the numbers painted on this background in white. At best, painted numbers are good for only a season or two and unless artistically done, are not generally satisfactory.

An interesting example of cutout numbers are shown in the photograph of the gate. To begin with, the location is logical because the eye is easily drawn to the novelty gate. Following the curve of the top rail of the gate, the numbers are gracefully placed. These numbers were cut from hardwood ⅜-inch thick and double dipped in enamel before placing. Then the brad heads were touched with white to cover them.

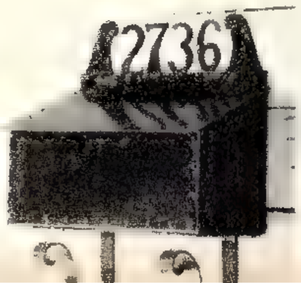
Cutout numbers can be mounted on a wood plaque which in turn is fastened to the roughly stuccoed wall. A neat effect results. The numbers are fastened to the plaque with brass screws after plaque and numbers are double painted. An interesting possibility of the wood cutout numbers is the third dimension which makes them more easily seen, particularly when slanting shadows bring them into prominent relief. Another way to accentuate this relief effect is to paint the

A small wooden plaque with numbers mounted on it is an attractive fixture which can be fastened to a concrete or stone wall. The numbers should be large enough to be seen from a reasonable distance.

Some persons prefer to use names instead of the more conventional numbers. Metal is good material to use, as it can be taken down when moving, and put up again at a new location.



NO NEED SLEUTHING FOR HOUSE NUMBERS WHEN PLAIN, HEAVY, CUT-OUT OR PAINTED-ON NUMERALS ARE USED.



FIRST AID For The SPORTSMAN

by Dr. C. W. Clifford

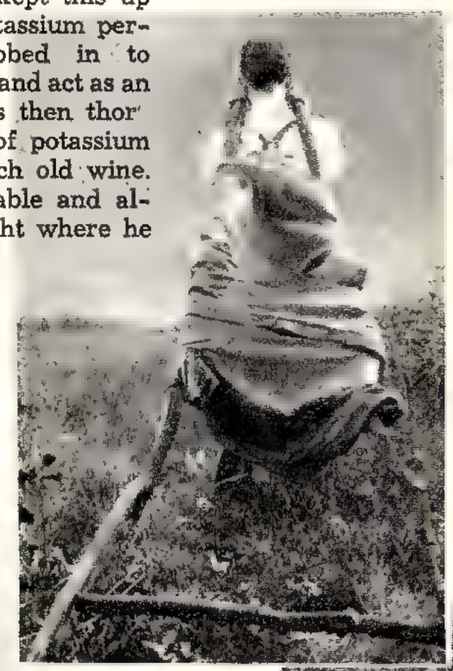
Every camper should include a first aid kit as an important part of his equipment. This unique kit compactly fits into an ordinary tobacco can.

HANK was going down stream pell-mell, stumbling, tripping and half falling over jagged rocks and protruding bolders. In his right hand he carried a light four-ounce rod and line securely fastened to a charge of steelhead dynamite. Trying to keep a tight line on this wild demon in his mad rushes and aerial attacks seemed impossible. In each zooming rush he seemed to climb higher only to tumble into the air again and fall back with a resounding splash, and then dash further down stream in bounding leaps, clearing the surface, shaking his head, twisting and prancing like a young colt that he might loose the sharp barbs that held him captive.

Suddenly Hank sprawled on the rocks, putting his hands out to break the fall. There was a wild agonizing scream as he attempted to gain his feet. Reaching his side I discovered that a rattler had sunk its piercing, sharp fangs into Hank's outstretched left arm as he tumbled headlong.

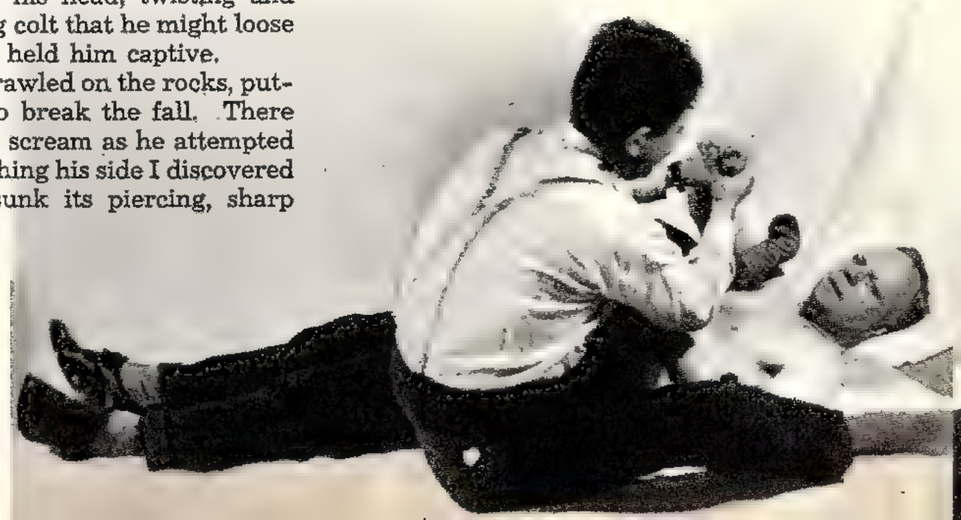
This called for immediate action. A tourniquet was placed above the wound. Taking a clean bandana handkerchief from my fishing coat, I tied it loosely about the upper arm. A small pebble was placed under this to give the required pressure. A stout green stick was placed so that it could be twisted until the circulation was practically shut off, not allowing the poison to reach the heart. In putting on a tourniquet one must always remember that it should be applied between the wound and the heart. With the small blade of my pocket knife I made incisions ¼-inch deep to let out the poison. The wounds were then sucked to draw out the poison. In doing this I was sure there were no abrasions in my mouth to let in the poison. I kept this up several minutes, after which potassium permanganate crystals were rubbed in to counteract any remaining poison and act as an antiseptic. My own mouth was then thoroughly rinsed with a solution of potassium permanganate the color of a rich old wine. The patient was made comfortable and allowed to rest for some time right where he was. This quiet rest is essential to keep down any unnecessary work on the heart.

The tourniquet was loosened for three or four minutes every half hour to prevent ultimate loss of the arm by mortification. Antivenom given according to directions brought the patient around in good shape. It is well



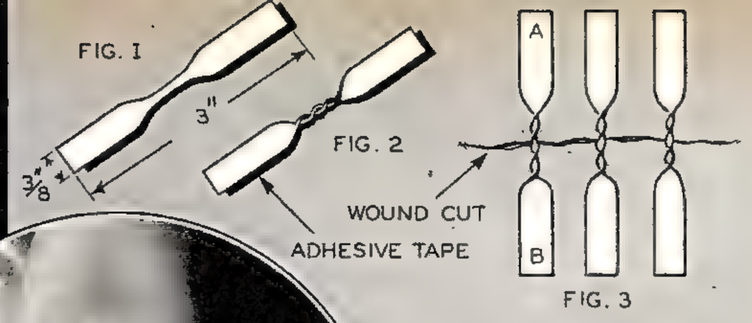
A one-man stretcher for carrying an injured person out of the woods can be made from two poles and a coat. Turn sleeves inside out, run poles through them and button up. Place patient on stretcher with his head resting forward.

Below—If a bone of the arm or leg is badly fractured a strong pull, with heel in arm pit, will be necessary to keep it straight. Keep the bones rigid with splints and bandage; then take patient to doctor at once for medical attention.



To reset a dislocated shoulder, remove patient's clothing to the waist, place your bare heel in his arm pit, then grasp his hand and turn well in toward center of body. Some force may be necessary before it will go back into place.

To apply a tourniquet to a limb so as to stop bleeding, tie handkerchief as shown above and twist with stick. Loosen every half hour for 3 or 4 minutes to prevent mortification. Right—Stitching a severe arm cut with adhesive tape.



If ready made adhesive stitching tapes are not available, they can be very easily made from ⅜-inch roll tape. Cut the tape first as shown in Fig. 1, then twist to give it strength as in Fig. 2.

to be prepared with a kit of this if you plan on going into a snake country. It will fit easily into your coat pocket, and so, is handy to carry. When you do not have this serum available it should be given as soon as it can be secured.

Did you ever stop to think that this might happen to you? Maybe someone else in your party gets hurt or bitten, breaks a leg, dislocates a shoulder or just gets sick. Physicians are not always close at hand when needed, especially if a mishap occurs far from the beaten path. In such cases it is necessary that every one who plans a trip that will take him far afield have some knowledge of what to do.

A fracture can be told by the symptoms which soon develop. There is loss of power, pain, swelling and the limb is out of its usual alignment. Set it by getting the broken ends together. A strong pull on the arm or leg, with your bare foot in the armpit or crotch, is usually necessary as the muscles have contracted and forced the stumps past each other. Hold the parts with a splint of cedar or other bark over a packing of anything soft such as a handkerchief and dry moss. Tie the bark on and if an arm put it in a triangular sling so that it will not hang down. A triangular sling is easily made from a big handkerchief and held up with a safety pin.

If it is a broken leg, you must get him out of the woods. Cut or find two poles about 15 feet long. With your coats make a carry by turning the sleeves in and putting the poles through. Button the coats up with the buttons down. Hold the poles apart with crotched sticks, fastening one end of each stick with your fish line. Place the patient on this stretcher with his head toward you, pick up an end of each pole as you stand between them and walk off with your burden letting the ends drag on the ground.

A sprained ankle on a fishing or hunting trip is quite common. It calls for cold packs for the first 24 hours. Cold towels from the coldest water you can get and changed every few minutes are next best to an ice pack to relieve pain and keep down swelling. Cold packs continuously applied produce a definite local anaesthesia and causes a temporary inhibition of inflammation in its early stages. It reduces the volume of the parts by lowering the temperature, contracting the vessels and tissues. (When you get home have it X-rayed; very often a bone is broken.) After twenty-four hours wet heat may be applied. A towel soaked in hot water and applied will increase the osmotic pressure, increasing the flow of lymph and carry away the products of the early stages of inflammation, pouring them into the blood stream to be disposed of.

Severe bleeding may come from either an artery or vein. If from an artery it will be bright red in color and come in spurts. If a large artery or vein is cut the tourniquet will stop it. In an emergency a shirt sleeve may save a life; don't hesitate, but act at once. In the case of ordinary cuts and where the bleeding is only moderate, use the surgical dressing. That is, cover with iodoform gauze; then hold in place with a bandage and fasten with adhesive tape. A long gash or cut may call for stitching. In amateur hands use the adhesive tape method; it is simple and quite efficient.

Cut strips of adhesive 3 inches long and ⅜ inches wide—then cut in center portion as shown. Twist the strips in opposite directions until they become thread-like in the center. Place end "A" on tissue, pull the edges of the wound together, then secure with end "B." Cover with surgical dressing.

Burns and scalds are an unpleasant occurrence on any trip and should be treated immediately. For simple burns picric acid ointment in tube form is very convenient and stops the pain at once. For the small kit put a little in a tin box and leave the big tube in the car. Tannic acid for the more severe burns and scalds is to be recommended. Make a 2% to 5% solution. For the small kit I carry 36 grains in a small bottle that measures ¾ inches in diameter and is 3¼ inches long.

This size bottle will just hold it and when it is put in 4 ounces (a glass full) of boiling water it makes a 2% solution. Soak the sterile gauze in this and put on a wet compress. The area should be kept covered with this wet dressing for from 36 to 48 hours or until the coagulum has formed. Medical care is advised as soon as possible. Don't use grease or fats of any kind! If they have been used remove them and follow the treatment above. Tea contains tannic acid. As a substitute make a pot of it ten times normal strength and use it as the wet dressing.

Every sportsman should have in his car or camp complete first aid equipment. There should be a small supply of medicines, antiseptics, a strychnine unit, plain and iodoform gauze, medicated cotton and cotton applicators, scissors and lance.

The medicines should include compound cathartic (CC-tablets); anacin tablets for headache; iodine for cuts, bruises and abrasions of the skin; aromatic spirits of ammonia is a restorative in cases of fainting or fatigue; mentholatum for chapped or cracked lips, insect bites and small abrasions and potassium permanganate crystals for snake bite. Three or four crystals dissolved in a glass of warm water makes a good mouth wash. It makes a good wash for infected wounds also. Just make it a good pink color; only a few crystals are needed.

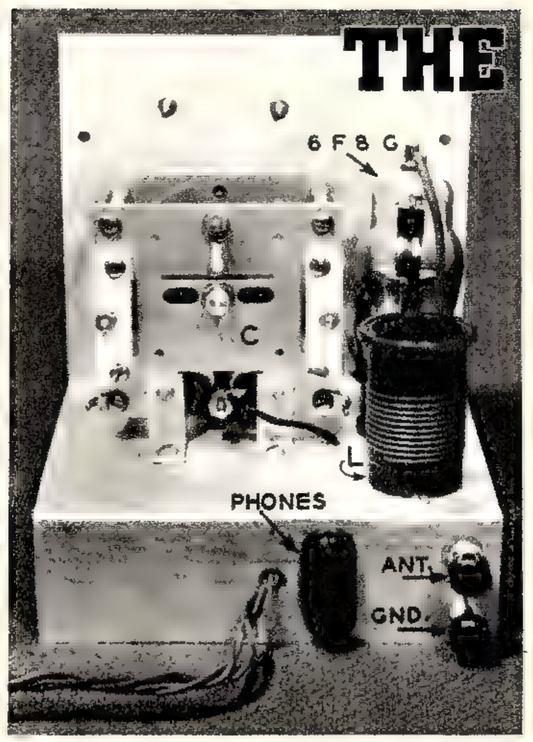
Add the following and you have a useful small kit that fits into a tobacco can: 1 small scissors, 1 small tweezers, 3 small envelopes with gauze and cotton applicators, 1 roll ½-inch adhesive tape, 1 roll ½-inch bandage, 1 small bottle alcohol.

Although the value of intelligently administered first aid cannot be over estimated, no attempt should be made to have it take the place of treatment by a physician. For any injury showing the slightest signs of seriousness, professional treatment should be obtained just as soon as possible, even at the risk of spoiling a vacation. Remember that it is far more important to lose a few days of a trip than to risk serious trouble or death.

Many persons overlook the danger of small scratches, cuts, and abrasions, and take no precautions against infection. A minute or two spent in swabbing some iodine over a cut may prevent hours of suffering.

Below—Cover a wound with a pad of plain or iodiform sterile gauze and hold it in position with a piece of rolled bandage. Secure the bandage with adhesive tape.

Right—To support a broken arm that has been placed in splints, make a triangular sling from a large handkerchief, bed sheet or clean white shirt.



Above—A front view showing the position of the two controls. If a smaller dial is used for the tuning control (C), the panel size can be reduced. Right—The rear view of the receiver shows the simple arrangement of the parts. Metal construction is used throughout.

THE simplest short-wave receiver that is capable of giving good results consists of one or two tubes with regeneration. Thousands of such receivers have been described in the past; they differ from one another mainly in the manner in which the tuned circuits are arranged and in the manner in which regeneration is obtained. The familiar tickler or capacity-feedback circuits are good, but somewhat tricky, in that extreme care in the design of the feedback circuit is necessary to obtain smooth control of regeneration.

The one-tube receiver described in this article has several advantages which have not been described in the past. First, there is no tickler or capacity feedback circuit; the familiar tickler is replaced by a tube, and regeneration is controlled by varying the r.f. input to the tube. Second, the same tube that is used as a "tickler" also is an audio amplifier, so that more than usual amplification is obtained. Third, one of the new twin triodes is employed, so that all the functions have been combined into a single-tube set.

The diagram of the receiver is shown in Fig. 1. Coil L and condenser C tune in the signal, which is fed to the detector triode, T1, which is one-half of a 6F8G tube. The output of T1 appears across R2 and R3 in series, and is applied to T2, which is the second half of the 6F8G. The output of T2 passes through the phones and back to the input coil and condenser. Now, R3 is bypassed, so that only the r.f. voltage across R2 is applied to T2. And since the phones are bypassed, the amplified r.f. signal is applied back to the grid of the first tube. Thus, regeneration is obtained and is controlled by the potentiometer R2. But T1 is a detector, and the audio part of the output appears across R3 and is applied to T2, amplified, and heard in the phones. This audio is not applied to T1, because the grid circuit of T1 is a radio-frequency circuit. T1 and T2 have been drawn separately only because of convenience. It is evident that regeneration is obtained without any tickler or trick circuits; T2 is both the feedback circuit and the audio amplifier.

A simple power supply unit for the Regenoflex is shown in Fig. 2. It consists of a power transformer, an 80 rectifier, two filter condensers, a choke, and a bleeder resistor. The values are given in the list of parts. If the power supply unit and chassis are built as separate units, only two wires are required to connect them, the ground wire and the B plus.

It is not essential that a power supply unit be used. When a storage battery is available to light the heater of the 6F8G, then 135 volts of "B" batteries is suitable.

Socket connections for the 6F8G are shown in Fig. 3. The socket is of the octal-base

TWIN TRIODE REGENOFLEX

by B. L. Goldring

One tube gives two-tube operation in this compact radio receiver.

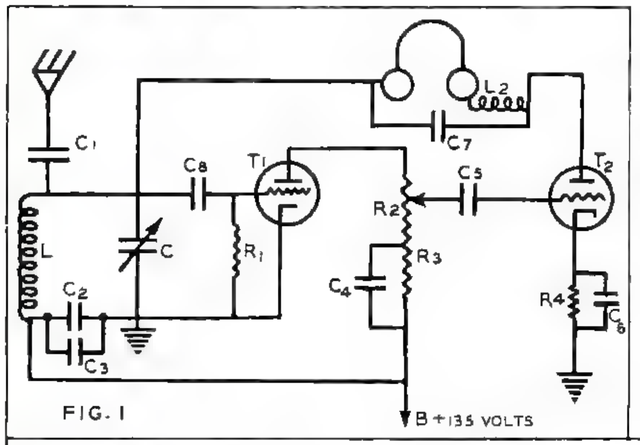


FIG. 1

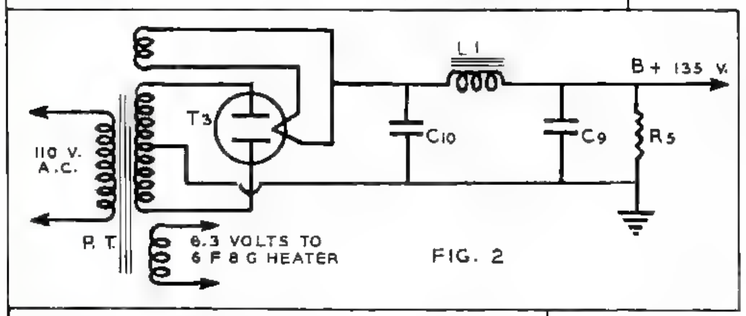


FIG. 2

SOCKET CONNECTIONS 6F8G
TOP CAP G2

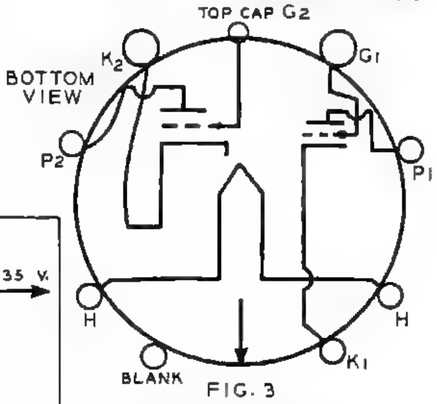


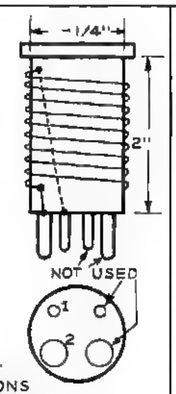
FIG. 3

Although the diagram shows two tubes, actually they are duplicate elements enclosed by one glass envelope. If a storage battery is available for supplying filament power, B batteries can be substituted for 110-volt power supply.

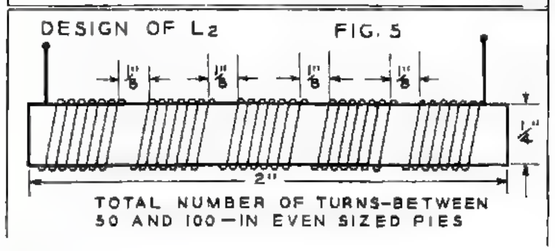
WAVE BAND METERS	NO. TURNS	WIRE SIZES	TURNS PER INCH
10–20	4-3/4	NO.22 D.S.C.	8
20–40	10-3/4	NO. 22 D.S.C	12
40–80	22-3/4	NO.22 D.S.C.	16
80–200	51-3/4	NO.28 D.S.C	40
200–350	60-3/4	NO.28 D.S.C.	CLOSE WOUND

COIL DATA

FIG. 4



SOCKET CONNECTIONS FOR COIL—TOP VIEW



type, and the arrow on the sketch shows the position of the keyway in the center of the socket.

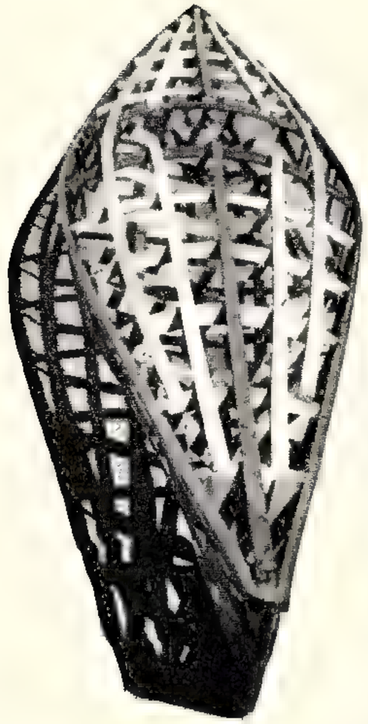
The receiver was constructed on an aluminum chassis 5″x6″x1⅞″. The aluminum panel is 6″x7″; it was made high enough to accommodate the large tuning dial. The arrangement of parts on the panel and on the chassis is clearly shown in the photographs. If a smaller tuning condenser and a smaller dial are available, the size of the receiver can be reduced.

Either section of the tube can be used for the input tube T1. Both have been tried and they work equally well. The section to use, then, depends entirely on the arrangement of the socket, the placement of antenna-ground posts, and the placement of the phone jacks. The rear-view photograph shows how these parts were arranged. The only rule to follow is to make the leads as short as possible.

The coils are particularly easy to construct.

[*Continued on page* 134]

You radio fans and electrical experimenters are in for a treat if you read the September issue of MECHANIX ILLUSTRATED, because the neatest little gadget you ever saw will be described. It worked so well when we tried it in the office, and we found so many uses for it, that the editors all agreed that it should be called "The Magic Wire." Complete directions and drawings for building it are given, and most experimenters will find all the necessary parts right in the shop.



Build This Simplified Canvas KAYAK

by Hi Sibley

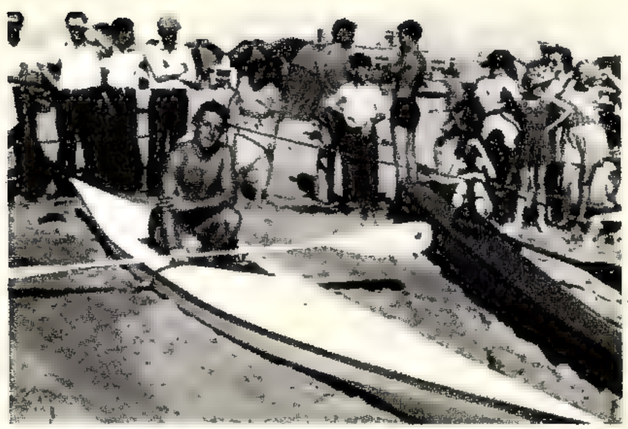
This photograph shows the kayak frame completed but not yet covered with water-proofed canvas.

TO ATTAIN maximum speed with minimum effort, most kayaks are built very long and extremely narrow, so that the lines actually resemble a toothpick. The narrow ones, however, are not easy for the amateur to handle. The one to be described is a much more stable type, having several inches more beam and not so much length. The weight and actual displacement compares favorably with the faster craft.

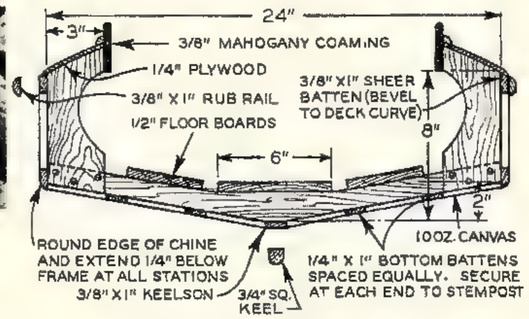
Throughout, this kayak is also designed for simplicity of construction, being identical at both ends, and the roomy cockpit exactly in the middle. Thus frames can be made in pairs, and are spaced the same distances apart. Stem and stern are exactly alike; this enables the passenger to paddle in either direction.

In narrow waters, or when one is in a hurry, it is not necessary to swing the craft around—not an easy task in limited space—instead, the passenger simply changes his position from one end of the cockpit to the other. This kayak, incidentally, will carry two comfortably.

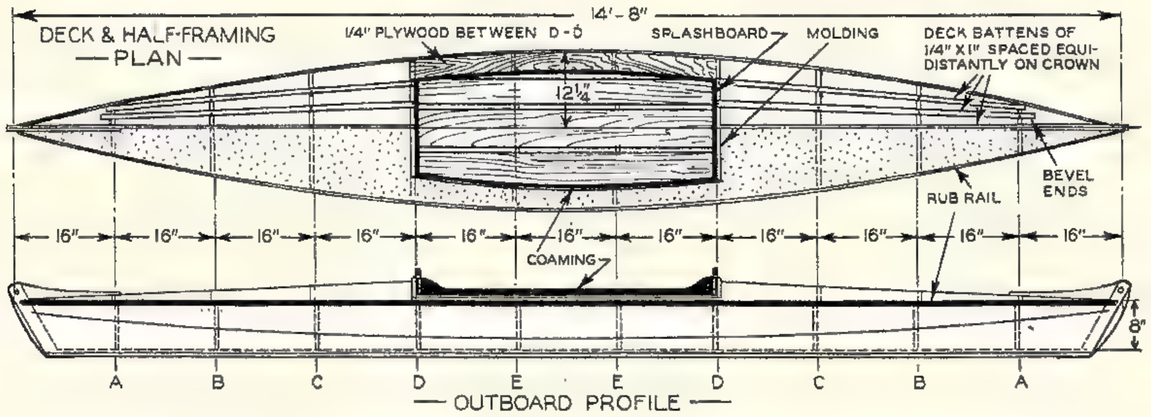
The first step is to build the frames, two each of A, B, C, D and E, and the two stems. When completed, set a 14-foot plank on edge and brace in this position. Lay a batten, or keelson



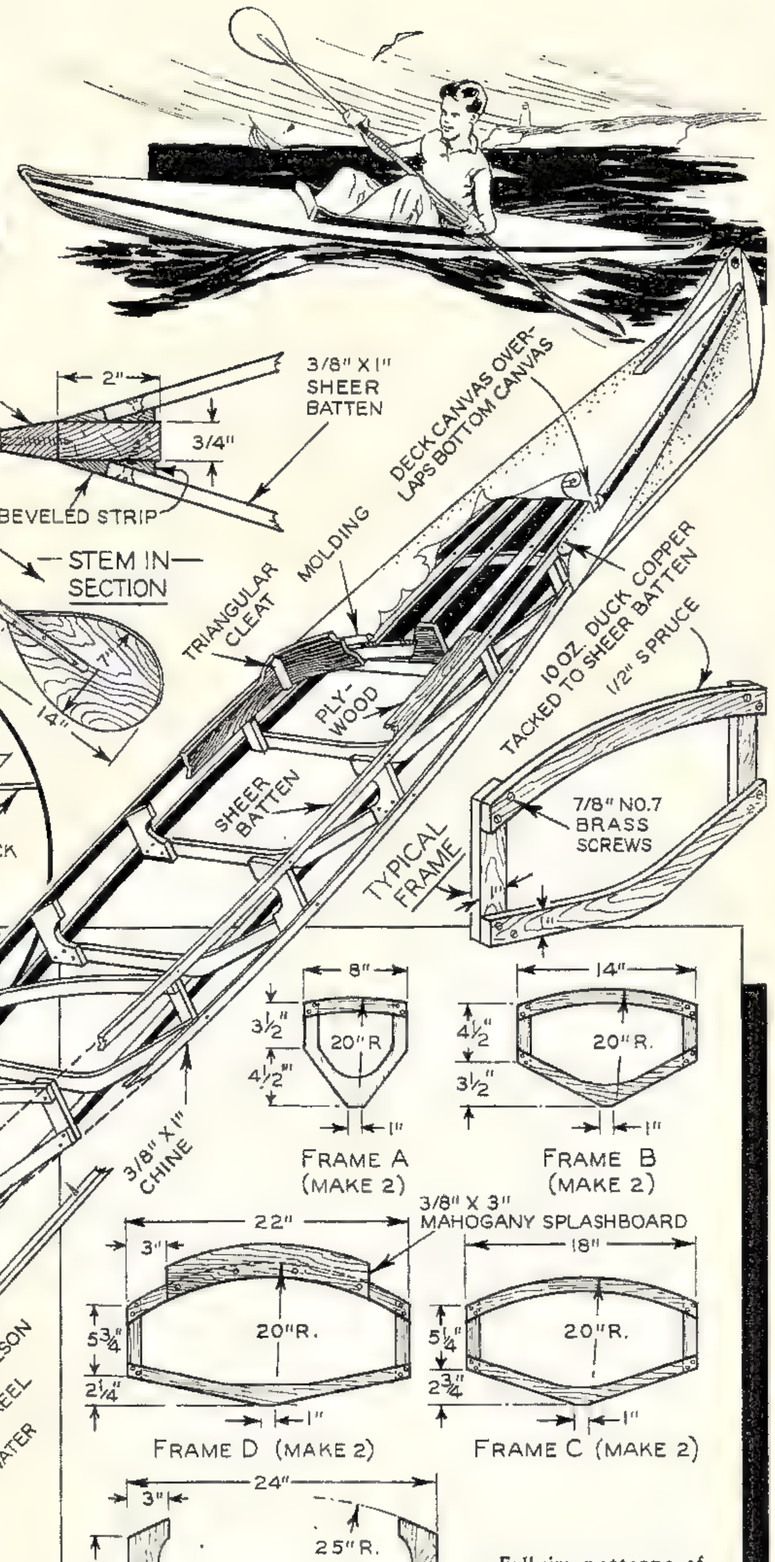
Right—Constructional details showing a cross-section at station E. Throughout, the kayak is designed for simplicity, being identical at both ends, with the cockpit in the center. The rectangular shaped cockpit makes construction considerably more simple for the beginner than the oval one.


24"
3"
3/8" MAHOGANY COAMING
1/4" PLYWOOD
3/8" X 1" RUB RAIL
1/2" FLOOR BOARDS
3/8" X 1" SHEER BATTEN (BEVEL TO DECK CURVE)
8"
6"
2"
10 OZ. CANVAS
ROUND EDGE OF CHINE AND EXTEND 1/4" BELOW FRAME AT ALL STATIONS
3/8" X 1" KEELSON
3/4" SQ. KEEL
1/4" X 1" BOTTOM BATTENS SPACED EQUALLY. SECURE AT EACH END TO STEMPOST

— CROSS-SECTION AT FRAME E —


14'-8"
DECK & HALF-FRAMING — PLAN —
1/4" PLYWOOD BETWEEN D-D
SPLASHBOARD
MOLDING
DECK BATTENS OF 1/4" X 1" SPACED EQUIDISTANTLY ON CROWN
12 1/4"
BEVEL ENDS
RUB RAIL
16" 16" 16" 16" 16" 16" 16" 16" 16" 16" 16"
COAMING
8"
A B C D E E D C B A

— OUTBOARD PROFILE —



— FRAME PLANS —

LAY OUT FULL-SIZE PATTERNS OF EACH FRAME

Full-size patterns of each frame should be laid out before attempting to cut the lumber. Ten-ounce duck should be used for covering.

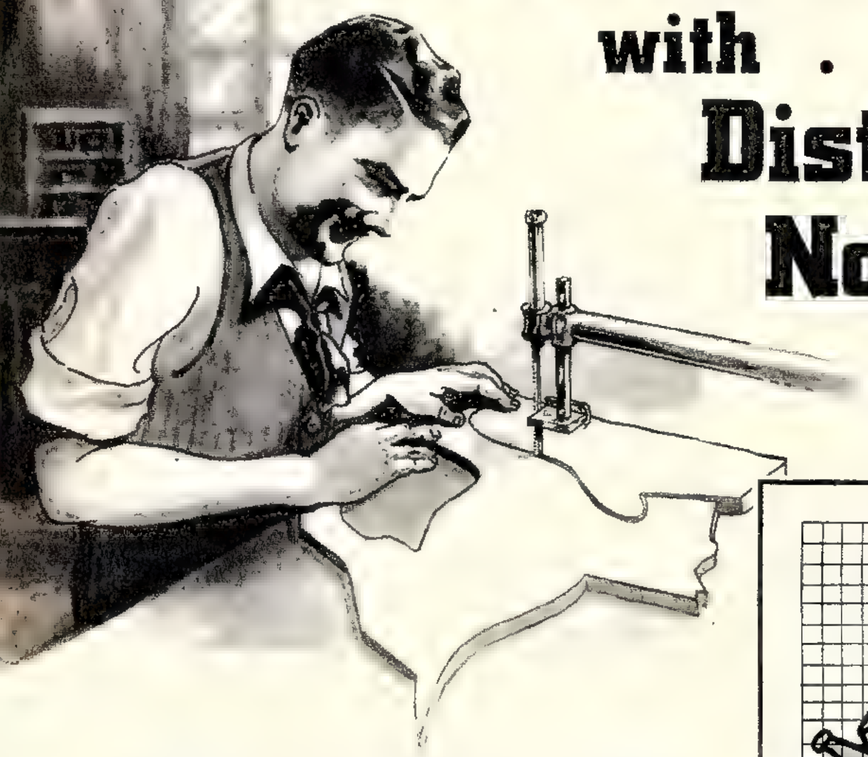
along the edge and mark it off into 16-inch spaces. To these, nail the frames in their relative positions, and install the sheer-battens to keep all in position. This is a temporary job, after which the battens are screwed to the frames with brass screws.

[*Continued on page* 134]

. . . SPICE YOUR LAWN . .

with . . . . . Distinctive Novelties

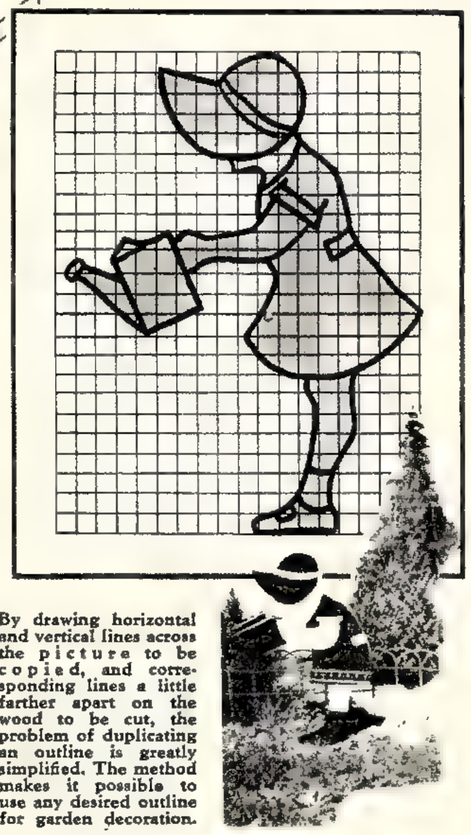
by
Dale R. Van Horn



EASILY made lawn novelties not only pep up a dull corner but add personality to the property itself. Cutouts in wood or metal can be made quite quickly and at little or no expense. The final result is a lawn or garden presenting an appearance obtained in no other way.

Cutting can be done with a hand coping saw, key hole saw, jig saw or band saw. After cutting out to the line, the pattern is removed and the edges sanded smooth. A priming coat of paint should follow, with particular attention paid to the end grain. Any small openings can be puttied before painting or larger ones filled with plastic wood. The second coat of paint should be of the predominating color of the character being portrayed. For instance, the little girl watering her posies has on a red dress and hat. So this second coat should be red. Then follow the trim coats with pink for the legs, face and arm. These two or three coats of paint will protect any wood novelties for two seasons against the weather. A good plan, however, is to repaint them each spring.

Supports for such novelties may be a sharpened continuation of the wood, which can be pushed into the ground, a sharpened stake fastened to the back side of the figure, or an iron rod, angle iron or strap iron fastened to the back side with screws.



By drawing horizontal and vertical lines across the picture to be copied, and corresponding lines a little farther apart on the wood to be cut, the problem of duplicating an outline is greatly simplified. The method makes it possible to use any desired outline for garden decoration.

The varieties of such novelties are legion. The accompanying photos do not begin to cover such possibilities. A short description of each follows.

The flower girl was cut from ¾-inch fir plywood. This figure stands 24 inches high and a stiff strap iron, bolted to the back side of the leg, projects downward 10 inches so that the figure will be held firmly upright when placed, yet can be moved about the grounds during the summer.

This is also particularly true of the mother and baby pelicans. With deliberately enlarged pouches, these birds border the ludicrous, but enliven any corner in which they are placed. They too were cut from thick plywood with the end grain—in fact all edges—well covered with paint to prevent weathering. Iron bars fastened to the back side support them. The bars are pushed down into the ground wherever wanted.

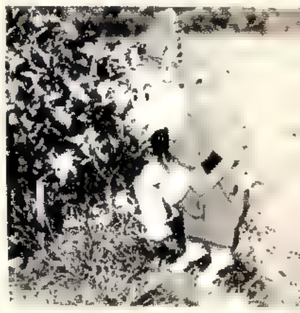
Supposed to be the last one in captivity, the doodle bug is strictly a comic. Being some-

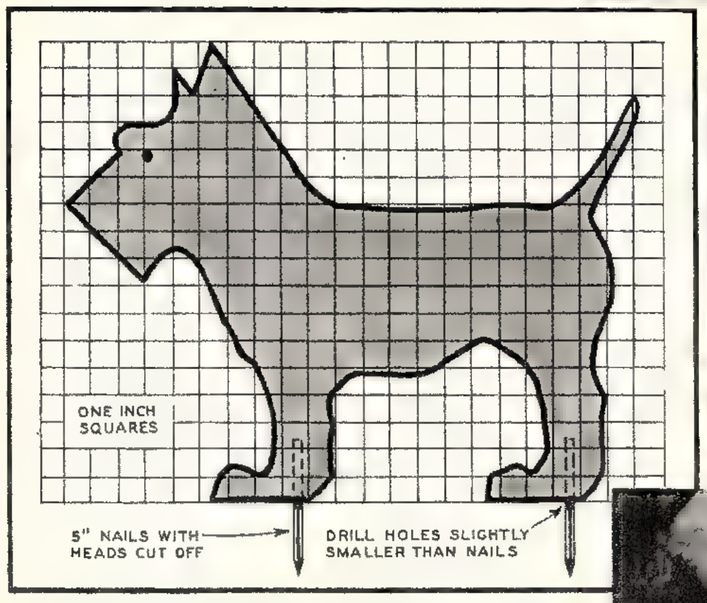
[*Continued on page* 138]

Wood working fans who like to build things for their house will find enough projects in the September issue of MECHANIX ILLUSTRATED to keep them busy for the next several months. When they see the directions for making gates, fences and trellises, they will want to start dressing up the house and yard immediately. As a matter-of-fact, anyone who has a house or a yard will wonder how they ever felt satisfied without these useful decorations.

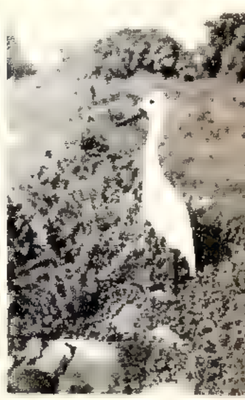
Those who enjoy having supper served outside in the yard or garden are going to find just the table and chairs they need when they see the article, "Weatherproof Garden Furniture" in the same issue.

With deliberately enlarged pouches, this mother and baby pelican border the ludicrous but enliven any corner in which they are placed. One of the "three little pigs" is a popular member of the lawn cutout family and always delights the children. Bright colors add to its appearance.





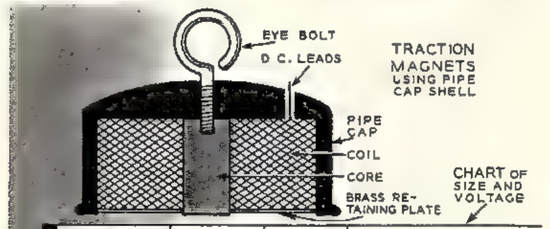
It is easy to have a life size prototype of this cute little scottie guarding your lawn. The black color makes a good background for the house numbers. The doodle bug shown above is one of the few in captivity. The head is mounted on a short length of clock spring or a hack saw blade and each puff of wind causes it to sway in a very knowing manner. This also is popular with children as well as grown-ups.



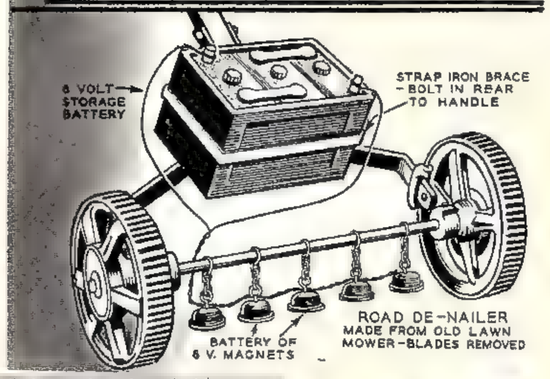
HOW TO MAKE ELECTRO-MAGNETS

by Kenneth Murray

The iron lamp base is held securely to the table by a concealed magnet.



SIZE PIPE CAP	DIA. CORE	VOLTAGE	SIZE MAGNET WIRE
3"	1"	1-1/2 V.	16
3"	1"	6 V.	24
3"	1"	32 V.	30
5"	1-1/2"	6 V.	18
5"	1-1/2"	32 V	26


6 VOLT STORAGE BATTERY
STRAP IRON BRACE - BOLT IN REAR TO HANDLE
BATTERY OF 6 V. MAGNETS
ROAD DE-NAILER MADE FROM OLD LAWN MOWER-BLADES REMOVED

WITH arm muscles bulging like knots and putting forth his mightiest effort, the brawny leader of an Algerian tribe was unable to budge even a small metal box which rested on a crude wood platform. It was then that Robert Houdin, a French conjuror from whom our own Harry Weiss was years later to coin his stage name of Houdini, walked over to the box and easily lifted it with one finger. The act proved to the tribesman that Frenchmen were the stronger and thus Robert Houdin, on a mission for the French government, was able to quell a threatened uprising of the Algerian natives. Not that the famous magician of those times was really the stronger; under the wood platform he had concealed a powerful electromagnet which was controlled by a switch underneath his foot!

This would be very useful if you ever wished to give a demonstration of your strength, but there are many other more practical ways in which electromagnets can be utilized about the home, shop and garage. Forming the essential part of all electric motors and dynamos, without them our entire scheme of living would be set back at least a hundred years. About the workshop will be found

When bolts, nuts or other metal parts have to be removed from narrow or inaccessible places, this narrow garage-type magnet will be very useful.

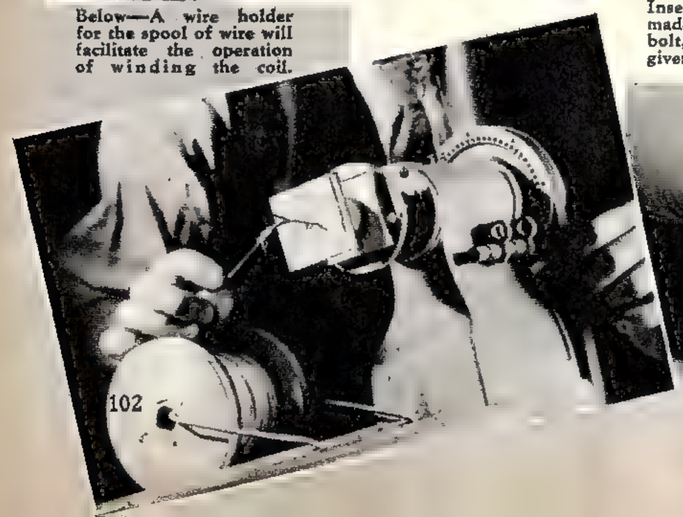
one type of magnet particularly useful:

Traction or Lifting Magnets. In even the small sizes these are capable of lifting up to several hundred pounds of iron or steel, and for carrying pounds of nails, screws and small parts from one place to another. By arranging a number of them underneath a wheeled support the tire-puncture hazzard can be eliminated. A good design consists in using a wrought-iron pipe cap for the magnet shell with an eye bolt for the handle, as shown in one of the illustrations. The core should be of either wrought iron or cast steel. Wind the coil separately, using the proper size of single cotton enamel magnet wire, in the same manner as was described in the June, 1938 issue for the winding of the welding transformer coils. When the magnet is to be used on more

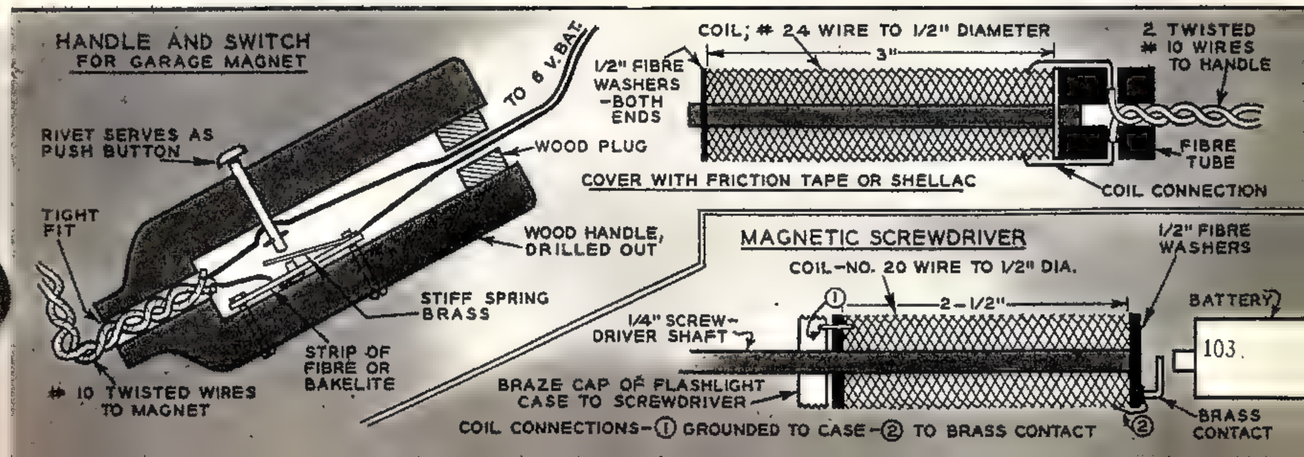
Above left—The traction or lifting magnet can hold several pounds when connected only to a single dry cell. Above—The garage type magnet showing the handle and magnet.

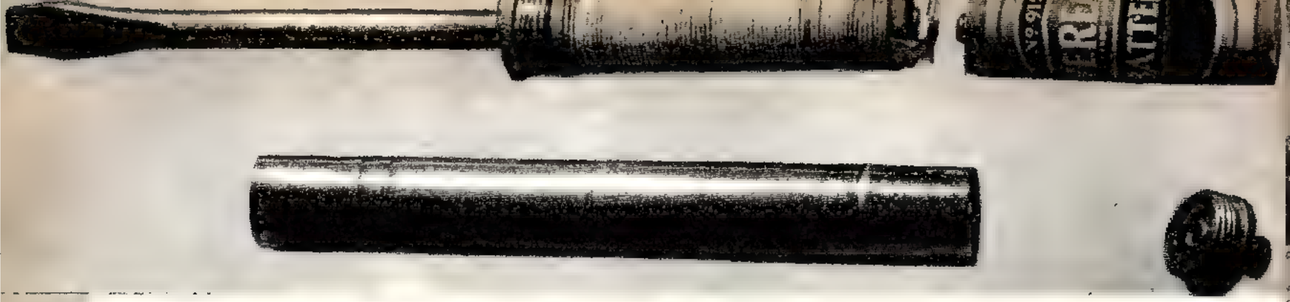
Below—Details for the construction of the screw driver, and garage type magnets. Right—The magnetic screw driver when completed will be capable of considerably more "pull" than the usual permanent magnet type.

Below—A wire holder for the spool of wire will facilitate the operation of winding the coil.

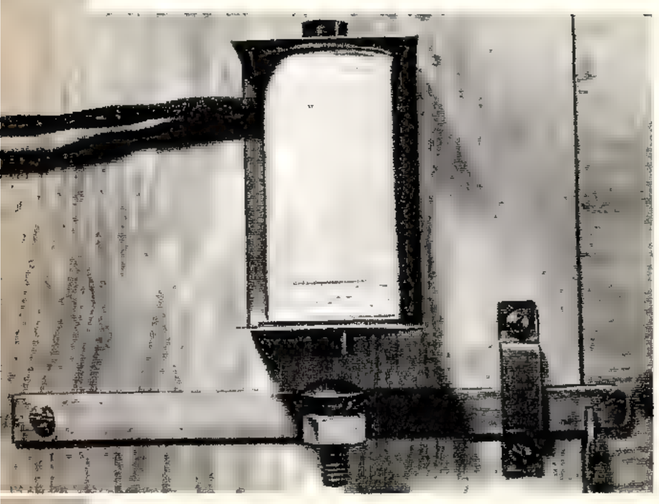


Inserting the cast-steel core in a heavy-duty lifting magnet made with a pipe cap. The core is held in place by the eye bolt, which also serves as a convenient handle. Above left is given construction information for various sizes of this type.

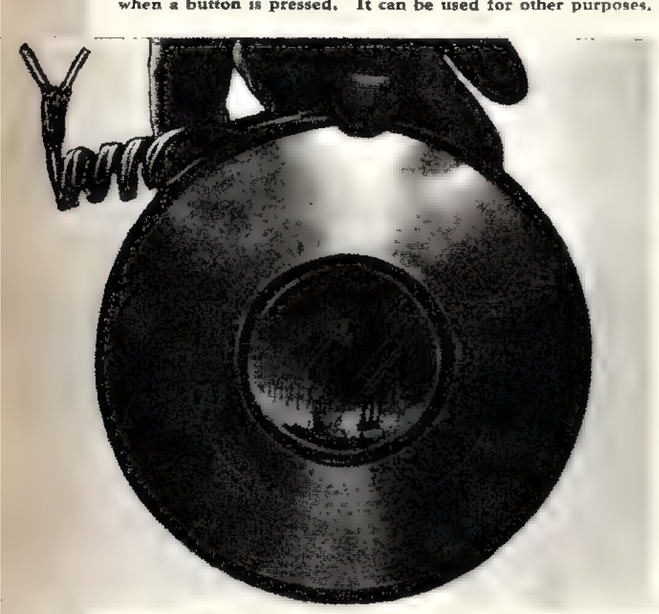

HANDLE AND SWITCH FOR GARAGE MAGNET
TO 6 V. BAT.
RIVET SERVES AS PUSH BUTTON
WOOD PLUG
TIGHT FIT
WOOD HANDLE, DRILLED OUT
STIFF SPRING BRASS
STRIP OF FIBRE OR BAKELITE
10 TWISTED WIRES TO MAGNET
COIL; # 24 WIRE TO 1/2" DIAMETER
3"
1/2" FIBRE WASHERS -BOTH ENDS
2 TWISTED # 10 WIRES TO HANDLE
FIBRE TUBE
COVER WITH FRICTION TAPE OR SHELLAC
COIL CONNECTION
MAGNETIC SCREWDRIVER
COIL-NO. 20 WIRE TO 1/2" DIA.
1/2" FIBRE WASHERS
2-1/2"
BATTERY
1/4" SCREW-DRIVER SHAFT
BRAZE CAP OF FLASHLIGHT CASE TO SCREWDRIVER
BRASS CONTACT
COIL CONNECTIONS-① GROUNDED TO CASE-② TO BRASS CONTACT



A single drycell is used to power the electromagnetic screwdriver. A pen type flashlight case is used for the handle.



An electromagnet can be used to open the latch of a door when a button is pressed. It can be used for other purposes.

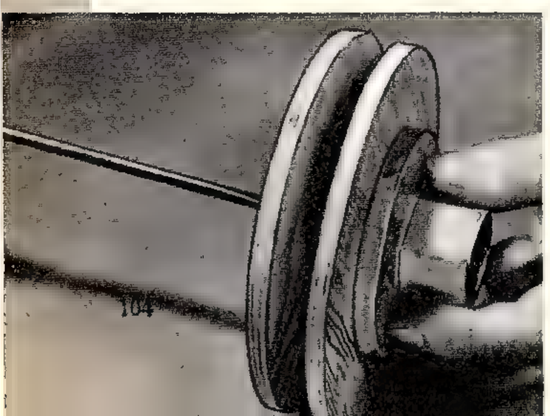


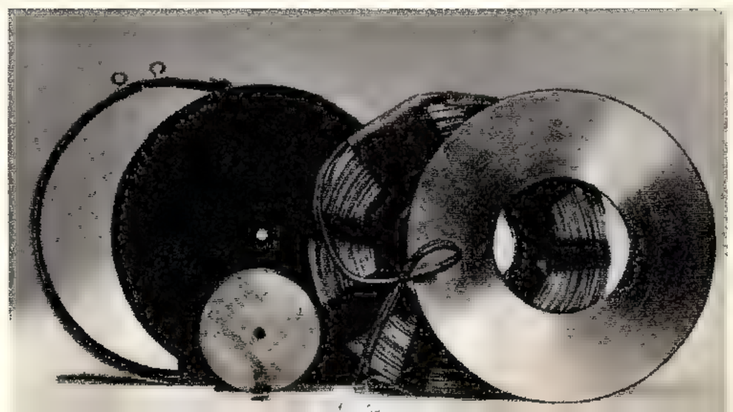
than 6 volts, it is good practice to cover each third layer of wire with a single thickness of shellacked paper. When winding magnet coils for direct current it is not necessary to count the number of turns; the coil in each case should be wound to fit snugly inside the space available, as determined from the measurements given in the drawings. If it is made smaller it will be become hotter in use; magnets should work at a temperature of not more than 131 deg. F. A larger coil than that called for will work at a lower temperature. In either case the "pull" or traction will be the same. A brass retaining plate will protect the coil and hold it inside the case.

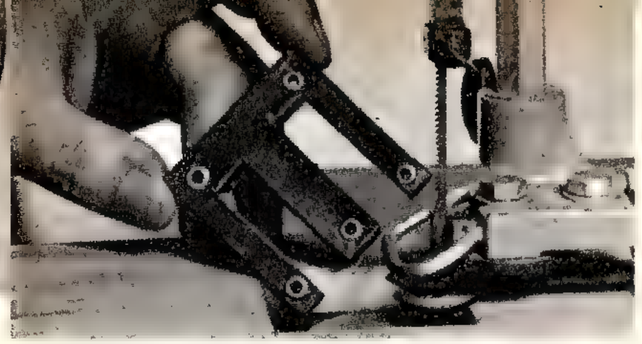
Garage Magnet: With this slender, long-handled magnet you will no longer find it necessary to take down parts of a motor or transmission to retrieve a dropped bolt, nut or other part. It will also remove fine particles of metal from the crankcase. Clips are attached for hooking directly to the bar battery, and a convenient switch in the handle enables the load to be picked up or dropped instantly.

The shaft is made by twisting together two S. C. E. No. 10 or No. 8 wires; be careful not to injure the insulation while twisting, as the wires are also utilized to carry the current to the magnet. A 3¼"x¼"-wrought iron machine bolt, with head removed, makes an easily-obtainable core. Also needed are two

Left—The pancake type magnet is very powerful for its small size. Below left—A wood form is used when winding the flat coil. Below—Parts for the flat magnet before assembly.







A wood form is used to hold the laminated iron core for the alternating current magnet while it is being cut on the scroll saw. Right—Turning over the rim to make a thin unit.

½" fiber washers and a ½" fiber tube, to be threaded over the end of the bolt for attaching the shaft. After winding the coil neatly, protect it and the shaft with several coats of shellac, or by wrapping with friction tape and then shellacking. This magnet will lift approximately ten pounds.

Magnetic Screwdriver: If you have ever wanted a screwdriver having more traction than can be obtained by converting it into a permanent magnet, you will find this electromagnet type satisfactory. Remove the handle from a screwdriver having a ¼" shaft, utilizing 6 inches of the latter for the coil. A new handle is provided in the form of a pen-type flashlight case, which should be brass. Braze or solder the cap that ordinarily holds and protects the lamp bulb, to the shaft of the screwdriver. When the parts are assembled this will leave room for a single cell and for making contact, which is usually formed when the battery is shifted forward by an outside device. Despite the small amount of power available, the screwdriver will have a pull of up to five pounds or more, depending on the reluctance (magnetic resistance) of the particular steel.

Door Latch Magnet: Ordinary door latches may easily be operated from a distance with an electromagnet by attaching a suitable armature to the latch arm, a wrought-iron bolt being used for this purpose. While one of the other magnets that have been described could be utilized, the one shown has a 3"x½"-wrought-iron core and the coil is wound to a diameter of 1½". To operate it on 3 dry cells, wind the coil with No. 10 wire; for 6 volts use No. 14 and for 32 volts use No. 20. If the same coil is to be used non-intermittently for another purpose on 32 volts, wind with No. 22 wire.

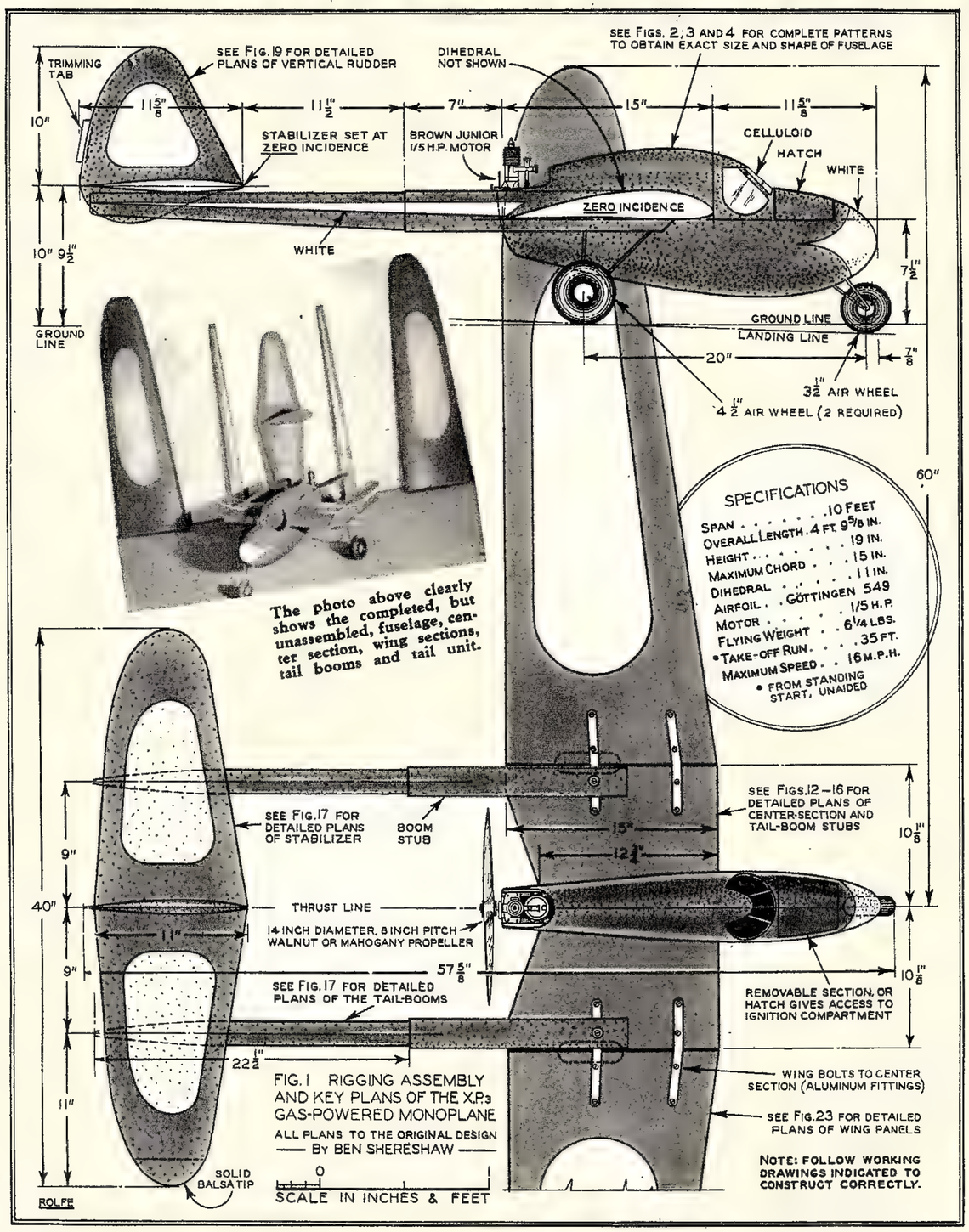
Pancake Magnet: This magnet was designed by the author for a well-known American magician, and while it is not as efficient

The alternating current magnet completed and ready for use. Rivets are used to hold the laminations together.

as some other designs, it is only ½" thick so that it can be concealed easily. The original purpose of the magnet cannot be revealed here, but the experimenter will find it interesting for many odd applications in restricted spaces. It is very powerful at close distances and, while designed for use on several dry cells, it will operate with increased traction if used intermittently on 6 or 12 volts. No. 18 magnet wire is wound to make a coil 5" in diameter and ½" thick, with allowance for a 2" diameter, ½" thick cast-steel core. The latter is tapped and bolted to the center of a 5" sheet-iron disc, placed on one side of the coil, with a 5" brass disc on the face side. The rim is a strip of ¾" wide sheet-iron which is formed into a hoop, slipped over the coil

[*Continued on page* 138]

Build This XP-3 Gas-Powered Model "PUSHER" Airplane


SEE FIG. 19 FOR DETAILED PLANS OF VERTICAL RUDDER
DIHEDRAL NOT SHOWN
SEE FIGS. 2, 3 AND 4 FOR COMPLETE PATTERNS TO OBTAIN EXACT SIZE AND SHAPE OF FUSELAGE
TRIMMING TAB
STABILIZER SET AT ZERO INCIDENCE
BROWN JUNIOR 1/5 H.P. MOTOR
CELLULOID HATCH
WHITE
ZERO INCIDENCE
WHITE
GROUND LINE
LANDING LINE
20"
3½" AIR WHEEL
4½" AIR WHEEL (2 REQUIRED)
60"
SPECIFICATIONS
SPAN . . . . . 10 FEET
OVERALL LENGTH . 4 FT. 9⅝ IN.
HEIGHT . . . . . 19 IN.
MAXIMUM CHORD . . . 15 IN.
DIHEDRAL . . . . . 11 IN.
AIRFOIL . . GÖTTINGEN 549
MOTOR . . . . . 1/5 H.P.
FLYING WEIGHT . . . 6¼ LBS.
*TAKE-OFF RUN . . . . 35 FT.
MAXIMUM SPEED . . . 16 M.P.H.
* FROM STANDING START, UNAIDED
SEE FIG. 17 FOR DETAILED PLANS OF STABILIZER
BOOM STUB
SEE FIGS. 12–16 FOR DETAILED PLANS OF CENTER-SECTION AND TAIL-BOOM STUBS
THRUST LINE
14 INCH DIAMETER, 8 INCH PITCH WALNUT OR MAHOGANY PROPELLER
SEE FIG. 17 FOR DETAILED PLANS OF THE TAIL-BOOMS
REMOVABLE SECTION, OR HATCH GIVES ACCESS TO IGNITION COMPARTMENT
WING BOLTS TO CENTER SECTION (ALUMINUM FITTINGS)
SEE FIG. 23 FOR DETAILED PLANS OF WING PANELS
NOTE: FOLLOW WORKING DRAWINGS INDICATED TO CONSTRUCT CORRECTLY.
SOLID BALSA TIP
SCALE IN INCHES & FEET
ROLFE

The photo above clearly shows the completed, but unassembled, fuselage, center section, wing sections, tail booms and tail unit.

FIG. 1 RIGGING ASSEMBLY AND KEY PLANS OF THE XP-3 GAS-POWERED MONOPLANE
ALL PLANS TO THE ORIGINAL DESIGN — BY BEN SHERESHAW —

Circle—Any miniature gasoline engine of 1/5 horsepower, such as this one, can be used to power the XP-3. Above—The model shows its graceful lines in this simulated flight position.

PART I

by Ben Shereshaw

THE building and flying of the XP-3 (experimental pusher) provides the gas modeler with a design incorporating structural and aerodynamic characteristics far different from those found in conventional gas models. In the development of the design many problems were encountered, necessitating the construction of three complete models—the XP-1, XP-2 and XP-3—before the "bugs" were eliminated.

The difficulties of the design were thoroughly ironed out with the construction of the XP-3, the take-off run being noticeably decreased, while the trim of the model remains almost constant after the engine has stopped. The construction details follow.

First plot out the eleven bulkheads in full size from the squared half-sections given in Fig. 4. Each pattern should be accurately drawn on stiff paper or cardboard and all notches such as for keel, motor bearers, etc., properly laid out and cut. Details of the required notches are shown in Fig. 4, and in other sketches. All bulkheads except No. 3 are of two-ply balsa. No. 3 bulkhead is a combination of 3-ply and 1-ply as will be seen from the construction sketches. The plywood is formed by laying opposing grains of $\frac{3}{32}$-inch sheet balsa in a good grade glue. The sheets should be pressed firmly together and left to dry for at least twelve hours.

Additional sections of the forward bulkheads will be required for the removable hatch so when laying out the patterns on the finished plywood sheets do not forget to include these pieces. The patterns should be lightly cemented to the surface of the plywood and the individual bulkheads cut out

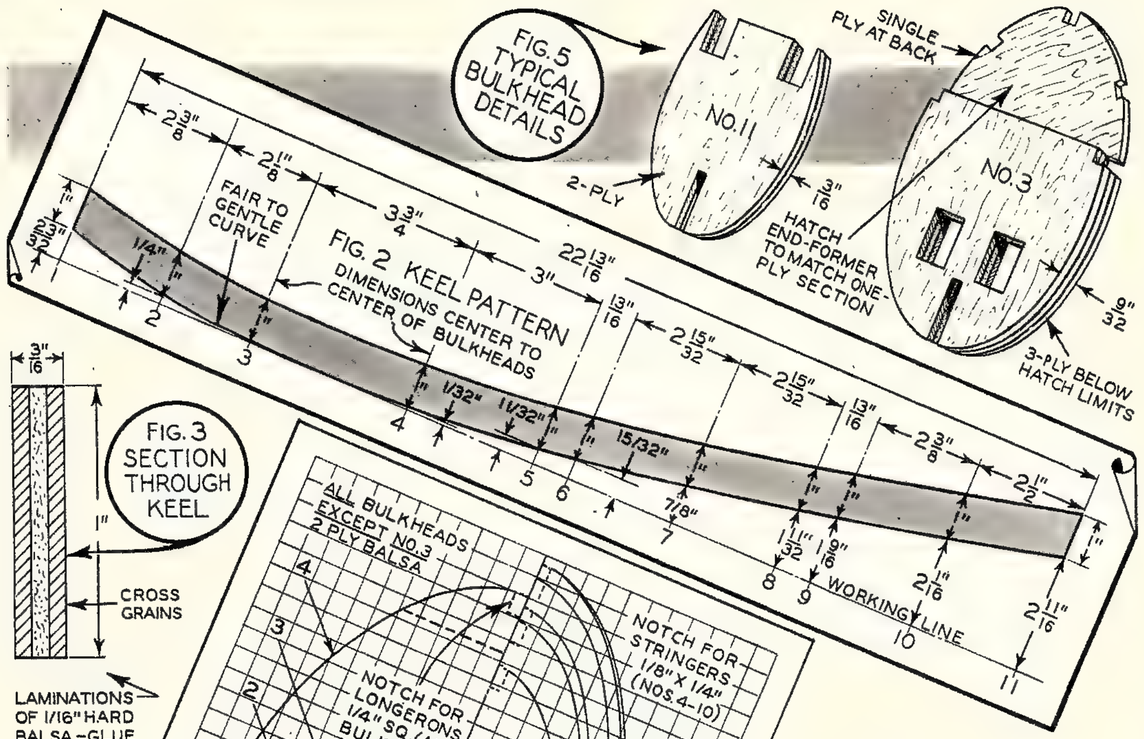


FIG. 5 TYPICAL BULKHEAD DETAILS
NO. 11
NO. 3
SINGLE PLY AT BACK
2-PLY
HATCH END-FORMER TO MATCH ONE-PLY SECTION
3-PLY BELOW HATCH LIMITS
FIG. 2 KEEL PATTERN
DIMENSIONS CENTER TO CENTER OF BULKHEADS
FAIR TO GENTLE CURVE
WORKING LINE
FIG. 3 SECTION THROUGH KEEL
CROSS GRAINS
LAMINATIONS OF 1/16" HARD BALSA.-GLUE WELL
ALL BULKHEADS EXCEPT NO.3 2 PLY BALSA
NOTCH FOR LONGERONS 1/4" SQ. (ALL BULKHEADS)
NOTCH FOR STRINGERS 1/8" X 1/4" (NOS. 4-10)
HATCH SECTION
3/8" X 3/4" NOTCHES ON NOS. 9, 10 AND 11
3/16" X 1" SLOT FOR KEEL (ALL BULKHEADS)
5/8" X 1" NOTCH FOR FRONT LAND. GEAR BLOCKS (NOS. 1, 2 AND 3)
1/4" SQUARES
FIG. 4 HALF-WIDTH BULKHEAD PATTERNS

with a slight margin allowed for beveling and sanding. Use a jeweler's saw to put in the various notches.

Now lay out the keel pattern in full size from the dimensioned plan given in Fig. 2. The keel is constructed in precisely the same manner as the bulkheads, but from three laminations of $\frac{1}{16}$-inch hard balsa, grains crossed.

The accurate formation of keel and bulkhead members is most important as these pieces determine the fuselage contour and dimensions. We are now ready to assemble the fuselage. Set up

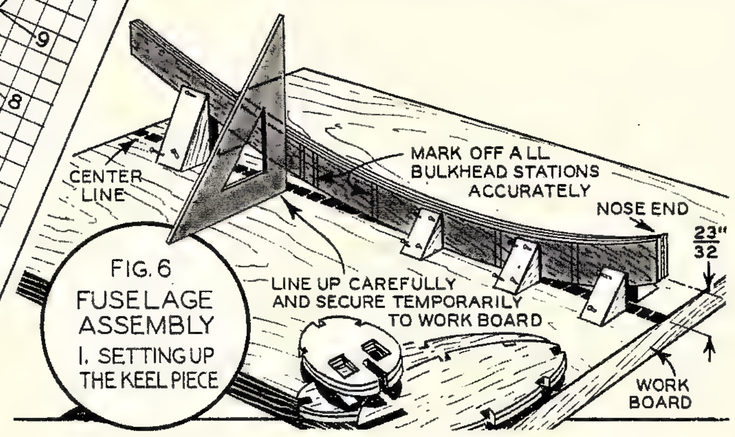
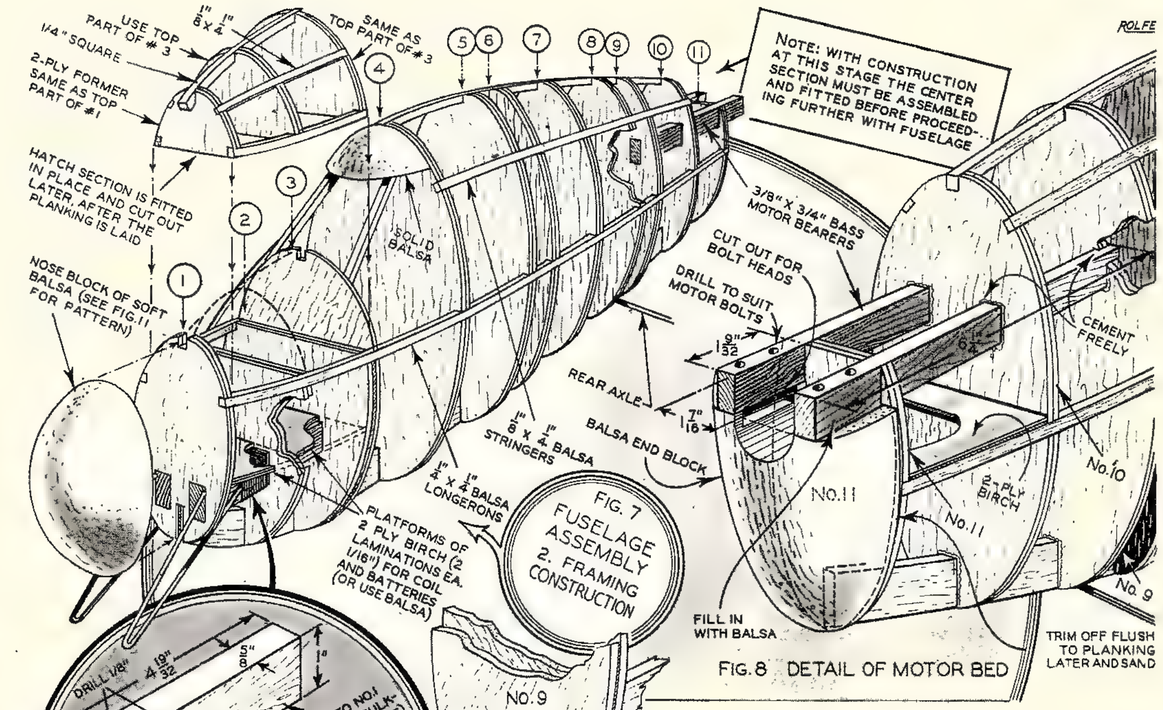


FIG. 6 FUSELAGE ASSEMBLY 1. SETTING UP THE KEEL PIECE
CENTER LINE
MARK OFF ALL BULKHEAD STATIONS ACCURATELY
NOSE END
LINE UP CAREFULLY AND SECURE TEMPORARILY TO WORK BOARD
WORK BOARD

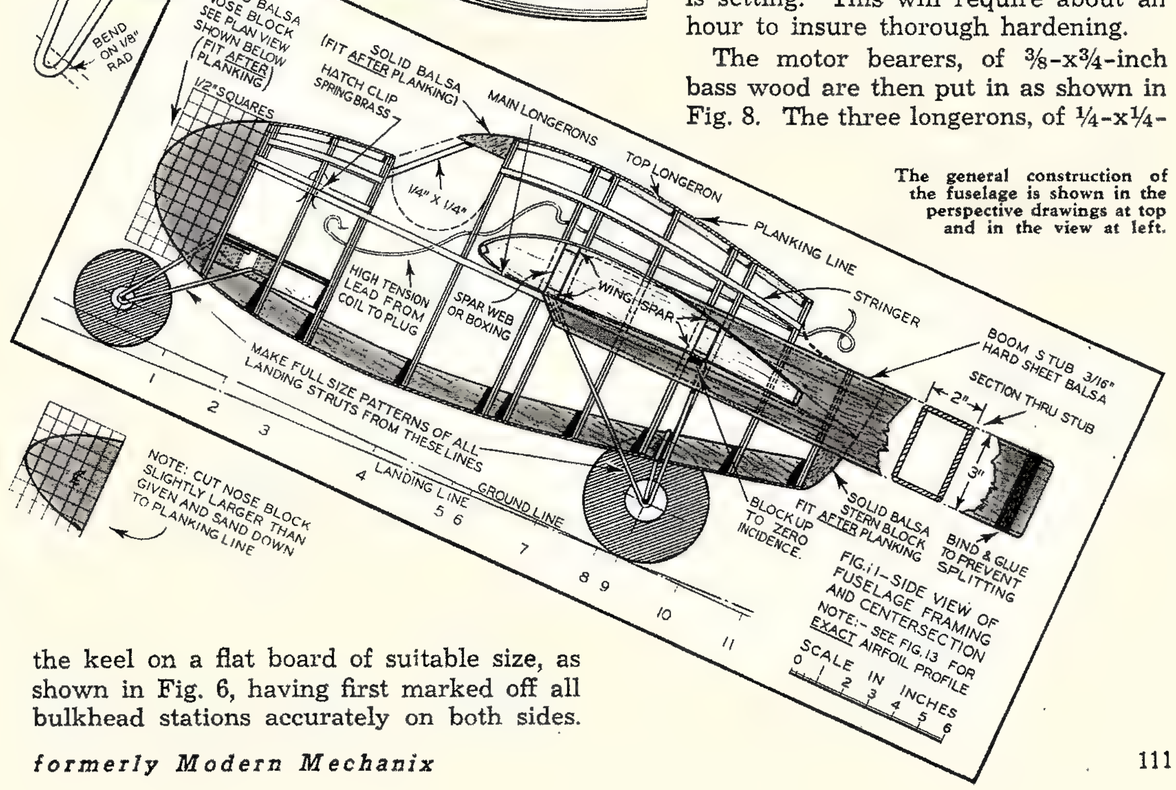
The first step in building the XP-3 is to lay out the keel and bulkheads. The sketches and patterns above show how these important parts are plotted, cut to shape and assembled.


ROLFE
NOTE: WITH CONSTRUCTION AT THIS STAGE THE CENTER SECTION MUST BE ASSEMBLED AND FITTED BEFORE PROCEEDING FURTHER WITH FUSELAGE
USE TOP PART OF #3
1/4" SQUARE
2-PLY FORMER SAME AS TOP PART OF #1
SAME AS TOP PART OF #3
HATCH SECTION IS FITTED IN PLACE AND CUT OUT LATER, AFTER THE PLANKING IS LAID
NOSE BLOCK OF SOFT BALSA (SEE FIG. 11 FOR PATTERN)
SOLID BALSA
3/8" X 3/4" BASS MOTOR BEARERS
CUT OUT FOR BOLT HEADS
DRILL TO SUIT MOTOR BOLTS
CEMENT FREELY
REAR AXLE
BALSA END BLOCK
1/8" X 1/4" BALSA STRINGERS
1/4" X 1/4" BALSA LONGERONS
PLATFORMS OF 2 PLY BIRCH (2 LAMINATIONS EA. 1/16") FOR COIL AND BATTERIES (OR USE BALSA)
FIG. 7 FUSELAGE ASSEMBLY 2. FRAMING CONSTRUCTION
NO. 11
NO. 10
3-PLY BIRCH
NO. 9
FILL IN WITH BALSA
TRIM OFF FLUSH TO PLANKING LATER AND SAND
FIG. 8 DETAIL OF MOTOR BED
DRILL 1/8"
CEMENT TO NO. 1 NO. 2 & NO. 3 BULKHEADS (SEE ABOVE)
GROOVE TO FIT STRUT
CEMENT AND BIND TO BASSWOOD BEARER
NO. 125 MUSIC WIRE
FIG. 9 DETAIL OF FRONT LANDING WHEEL STRUTS
GLUE & BIND TO KEEL
.125 MUSIC WIRE BENT TO SHAPE OVER FULL-SIZE LAYOUT
FIG. 10 DETAIL OF REAR AXLE ANCHORAGE
BEND ON 1/8" RAD

Check the vertical and longitudinal alignment of the keel and secure it, temporarily, to the assembly board with the nose end exactly 23/32-inch above the board line. Cement the bulkheads in place, checking their alignment and holding them in place with temporary braces while the cement is setting. This will require about an hour to insure thorough hardening.

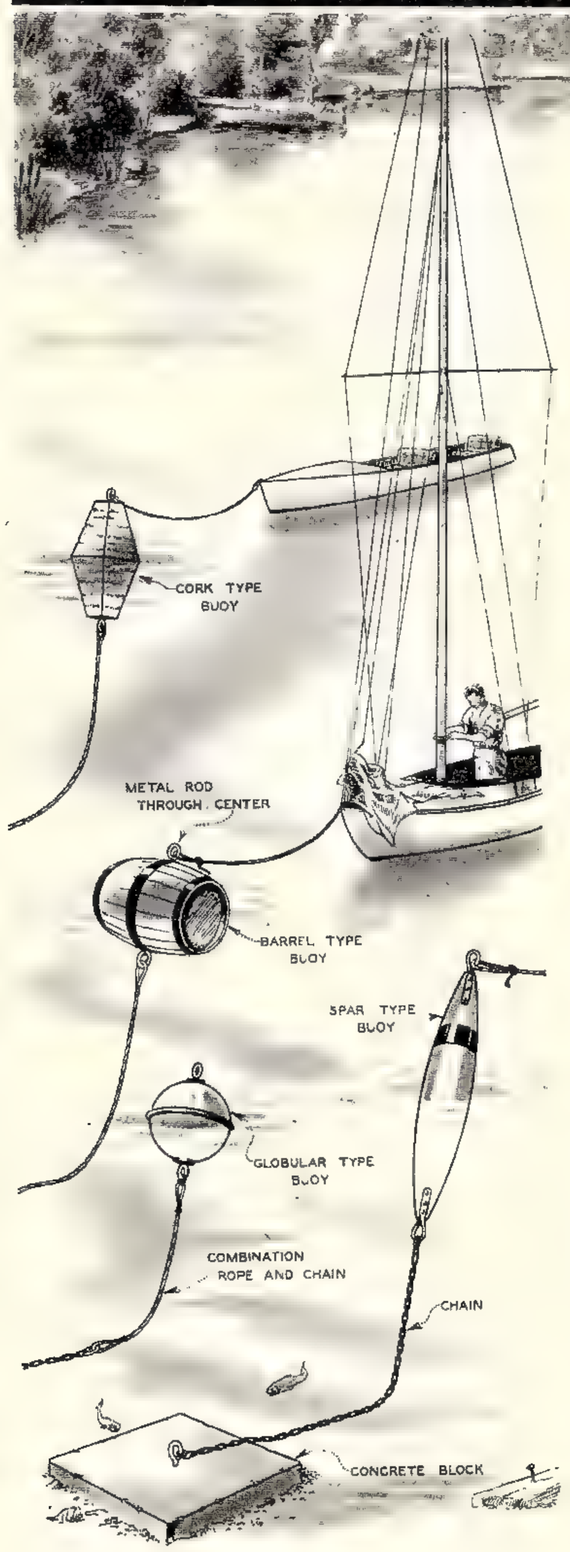
The motor bearers, of $\frac{3}{8}$-x$\frac{3}{4}$-inch bass wood are then put in as shown in Fig. 8. The three longerons, of $\frac{1}{4}$-x$\frac{1}{4}$-

The general construction of the fuselage is shown in the perspective drawings at top and in the view at left.


SOLID BALSA NOSE BLOCK SEE PLAN VIEW SHOWN BELOW (FIT AFTER PLANKING)
SOLID BALSA (FIT AFTER PLANKING)
HATCH CLIP SPRING BRASS
1/2" SQUARES
MAIN LONGERONS
TOP LONGERON
PLANKING LINE
STRINGER
1/4" X 1/4"
HIGH TENSION LEAD FROM COIL TO PLUG
SPAR WEB OR BOXING
WING SPAR
BOOM STUB 3/16" HARD SHEET BALSA
SECTION THRU STUB
2"
3"
MAKE FULL SIZE PATTERNS OF ALL LANDING STRUTS FROM THESE LINES
NOTE: CUT NOSE BLOCK SLIGHTLY LARGER THAN GIVEN AND SAND DOWN TO PLANKING LINE
LANDING LINE
GROUND LINE
BLOCK UP TO ZERO INCIDENCE.
SOLID BALSA STERN BLOCK FIT AFTER PLANKING
BIND & GLUE TO PREVENT SPLITTING
FIG. 11 SIDE VIEW OF FUSELAGE FRAMING AND CENTERSECTION
NOTE:- SEE FIG. 13 FOR EXACT AIRFOIL PROFILE
SCALE IN INCHES

the keel on a flat board of suitable size, as shown in Fig. 6, having first marked off all bulkhead stations accurately on both sides.

How To Moor



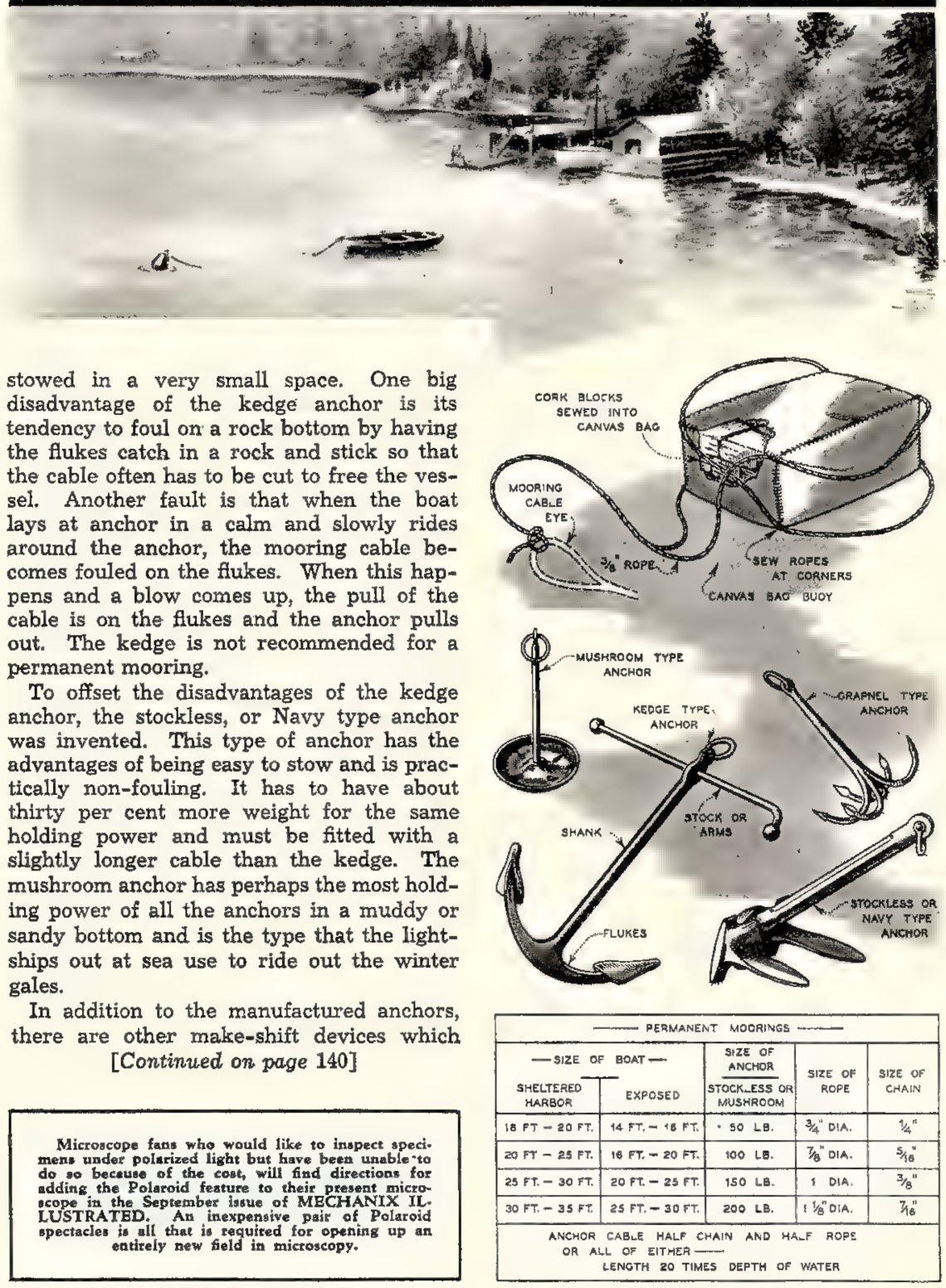
by Sam Rabl

INSURANCE statistics of marine casualities show that over forty per cent of damages paid are caused by bad anchor devices. Many an owner will lavish money on expensive fittings for his boat and then through either ignorance or a desire to save money on an accessory that is not visible will trust her future to inferior ground tackle.

There are as many kinds of anchors as there are boats; they range from the humble block of a discarded auto motor to the expensive bronze anchors of the folding type. The kedge anchor is the most common type, being what every one conceives when the word anchor is mentioned. It consists of three parts, starting from the bottom, the flukes, the shank, and the arms or stock. The function of the flukes is to dig into the mud and are the real holding power, the stock tends to keep the anchor in a position that the flukes will "bite." The shank forms the connecting bar between the flukes and the stock. Without a doubt, weight for weight, the kedge anchor has more holding power than any other type. It has a number of disadvantages, the greatest being its unwieldiness aboard a small boat. To overcome this difficulty the arms are sometimes made to slide through the shank so that it may be laid flat on the deck.

A further improvement on the kedge anchor is the folding kedge in which both the arms and flukes fold against the shank. This allows the anchor to be

The Small Boat



stowed in a very small space. One big disadvantage of the kedge anchor is its tendency to foul on a rock bottom by having the flukes catch in a rock and stick so that the cable often has to be cut to free the vessel. Another fault is that when the boat lays at anchor in a calm and slowly rides around the anchor, the mooring cable becomes fouled on the flukes. When this happens and a blow comes up, the pull of the cable is on the flukes and the anchor pulls out. The kedge is not recommended for a permanent mooring.

To offset the disadvantages of the kedge anchor, the stockless, or Navy type anchor was invented. This type of anchor has the advantages of being easy to stow and is practically non-fouling. It has to have about thirty per cent more weight for the same holding power and must be fitted with a slightly longer cable than the kedge. The mushroom anchor has perhaps the most holding power of all the anchors in a muddy or sandy bottom and is the type that the lightships out at sea use to ride out the winter gales.

In addition to the manufactured anchors, there are other make-shift devices which

[*Continued on page* 140]

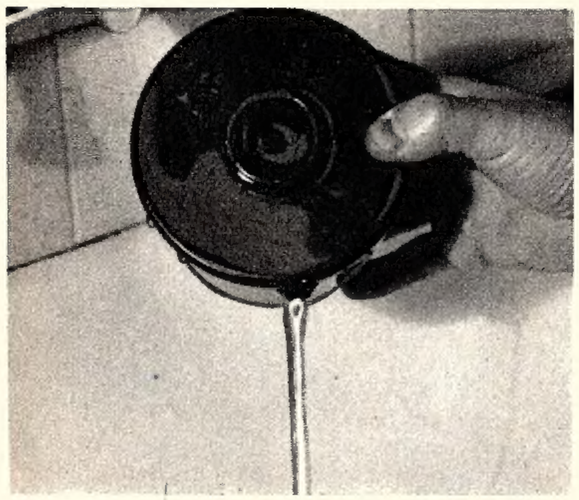
Microscope fans who would like to inspect specimens under polarized light but have been unable to do so because of the cost, will find directions for adding the Polaroid feature to their present microscope in the September issue of MECHANIX ILLUSTRATED. An inexpensive pair of Polaroid spectacles is all that is required for opening up an entirely new field in microscopy.

PERMANENT MOORINGS				
SIZE OF BOAT		SIZE OF ANCHOR	SIZE OF ROPE	SIZE OF CHAIN
SHELTERED HARBOR	EXPOSED	STOCKLESS OR MUSHROOM		
18 FT. – 20 FT.	14 FT. – 18 FT.	50 LB.	3/4" DIA.	1/4"
20 FT. – 25 FT.	18 FT. – 20 FT.	100 LB.	7/8" DIA.	5/16"
25 FT. – 30 FT.	20 FT. – 25 FT.	150 LB.	1 DIA.	3/8"
30 FT. – 35 FT.	25 FT. – 30 FT.	200 LB.	1 1/8" DIA.	7/16"

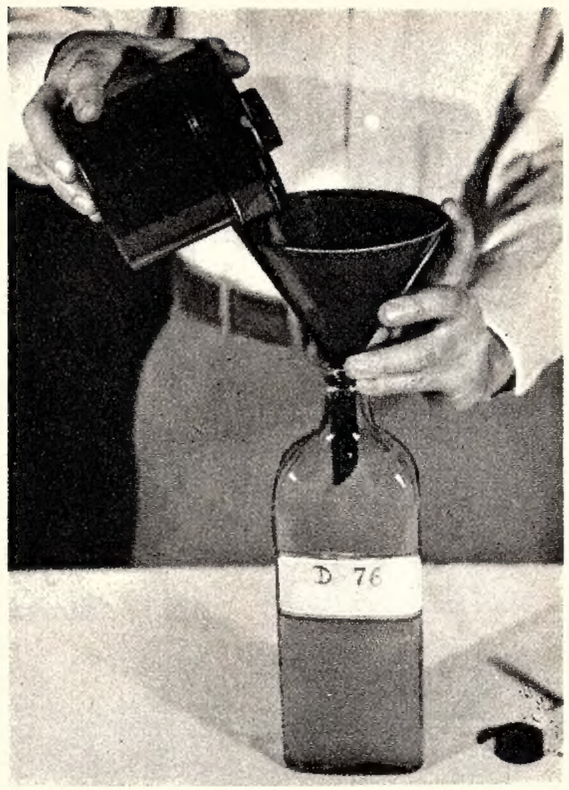
ANCHOR CABLE HALF CHAIN AND HALF ROPE OR ALL OF EITHER — LENGTH 20 TIMES DEPTH OF WATER

No. 5: While film is developing, filter correct amount of hypo, after rinsing funnel and jar a second time. Give tank a twirl occasionally. Adjust hypo temperature to same warmth as developer, or at least within one or two degrees, by immersing jar in hot or cold water, as required.

No. 7: Adjust running water to developer temperature. Rinse out tank four or five times (with lid on!) to remove all traces of developer. If no running water is available rinse with water from bottle; empty into pail or another bottle.

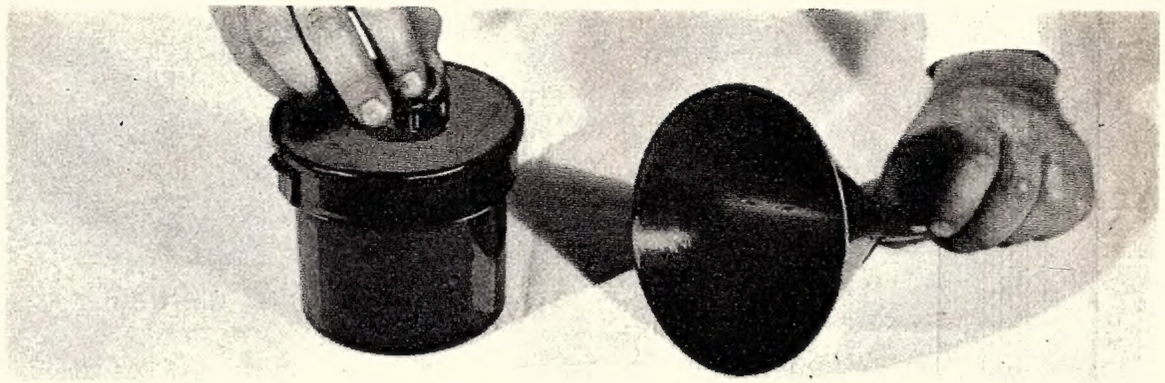


No. 8: Empty tank after each filling with water. Thorough water-wash very important. If developer is left on film, action of hypo on it sometimes causes "pinholes".



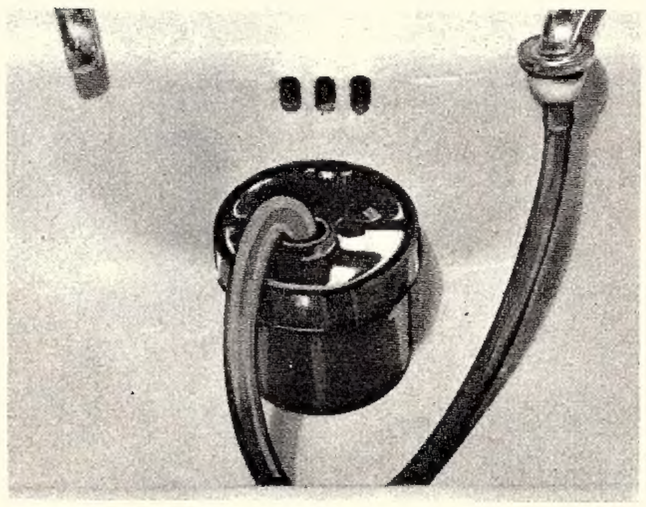
No. 6: After developing time has elapsed, pour developer back into bottle, using thoroughly rinsed funnel. Most fine-grain developers can be used over and over if kept in tightly corked bottles. Screw caps are better than ordinary corks; latter tend to jump out if bottle is full.

No. 9: After tank is drained of water, pour in hypo (previously filtered). Pour slowly to prevent splashing. Note time. Leave hypo in 15 minutes; this is standard regardless of type of film or developer.

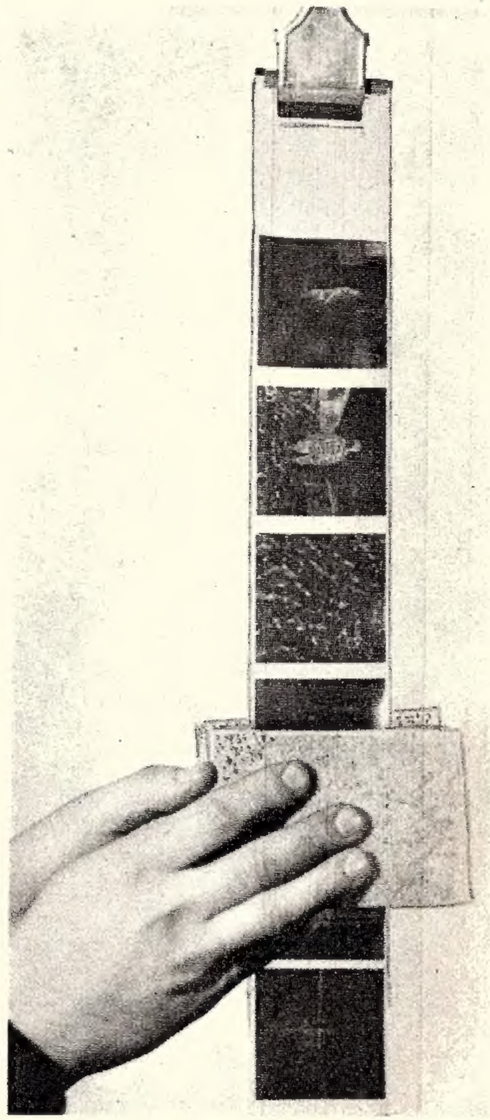


No. 10: After pouring in hypo, twirl reel slowly for one minute: then again once every minute for five minutes. Agitation during both developing and fixing will eliminate streaking and other blemishes on the film.

No. 11: After 15 minutes, pour hypo back into original bottle. A half-gallon of hypo will fix about two dozen average size roll films. Don't save it too long; it's cheap and easy to mix. Same hypo can be used later to fix prints—either contact or enlarged.

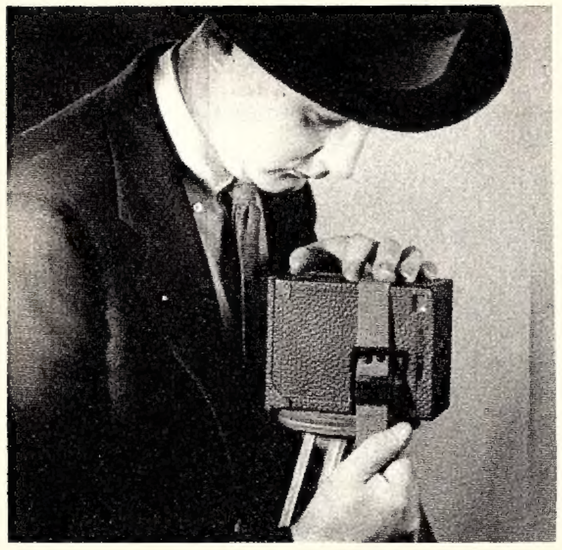


No. 12: Wash film thoroughly with cold water, using short piece of rubber hose and faucet adapter. Take out film reel occasionally to break up any bubbles forming on it. Wash for minimum of 15 minutes; 20 to 30 minutes will remove all traces of hypo and leave film perfectly clean.



No. 13: Unwind film from reel, hang in dust-free spot. Wet two halves of viscose sponge (made specially for film drying); squeeze out, then make sandwich with film between. Start at top, and wipe down evenly. Squeeze out sponges again, wipe downward second time. Film will then dry perfectly clean without spots or streaks. When dry, handle only by its edges.

PHOTO KINKS



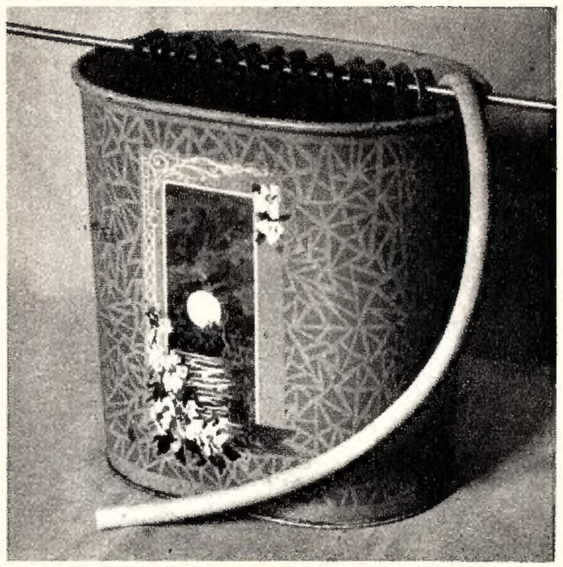
ATTACHING BOX CAMERA TO TRIPOD. When the lens aperture of a box camera is stopped down, and time exposures used, the results frequently are as good as can be obtained with a more expensive camera. The camera can be mounted securely to the tripod with a luggage or book strap.

FILTERING DEVELOPER QUICKLY. When time must be saved, solutions can be filtered quickly by using a nickel-wire strainer lined with a layer of cotton. If the strainer is not nickel plated, it should be coated thinly with asphalt varnish.

INEXPENSIVE TINTING SOLUTION. Ordinary black coffee is suitable for giving prints an even buff-to-sephia tint. The strength of the coffee can be determined by experiment.

SEALING DEVELOPER BOTTLES. A rubber cork of the expansion type, used for bottles of charged water, is a convenient and efficient cork for sealing bottles of developer.

KEEPING PRINTS FLAT. Glossy prints will remain flat if the backs are coated with "hair set" liquid after they are placed on tins. If the hair set is very thick it should be thinned slightly with water.

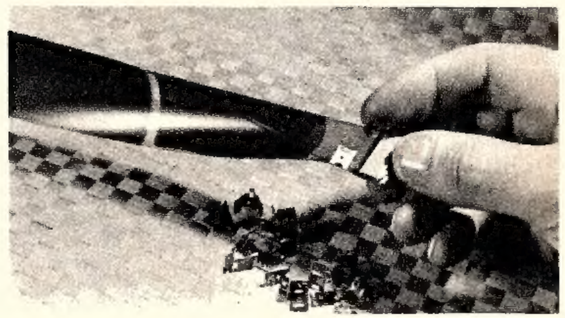


AN EFFICIENT WASHING TANK. A tin waste basket can be converted into a practical washing tank for filmpack or cut film. Be sure to seal any leaks in the edge before attempting to use it.

TRIMMING CURLED PRINTS. When photographs are not entirely flat, it is difficult to trim the edges evenly. To assure straight cuts, place a ruler over the edge of the print next to the trimmer blade to hold it in an even plane.

TRAY FOR DEVELOPING LARGE PRINTS. Prints of large size can be developed in a tray made of an old window pane with rabbeted pieces of wood attached to each side. The glass bottom and wood sides should be given two coats of asphalt varnish before use.

MOISTENED LIP OF TRAY AIDS POURING. When pouring from a pan or tray into a bottle, it is difficult at times to start the flow in the right direction. If the lip of the vessel is moistened, the fluid will follow the trail of moisture and not spill out at an unexpected point.

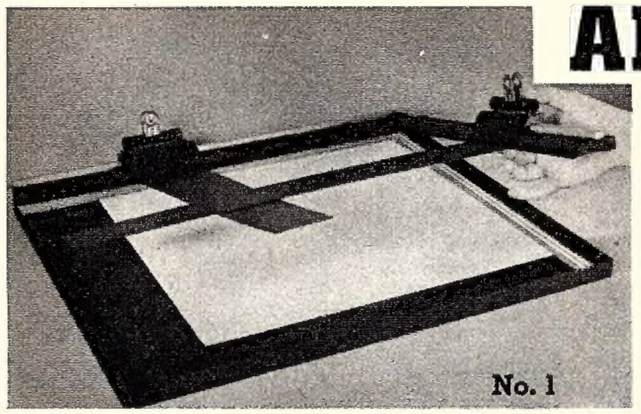


PREVENTING CURLING OF ROLL FILMS. Unless roll films are prevented from curling while in the hypo solution, portions may not become thoroughly fixed. Films will lie flat in a tank if the ends are fastened together with small clips as shown above.

ADJUSTABLE ENLARGER EASEL

by Reginald O. Lissaman

Holds paper flat during exposure and makes even white margins of adjustable size.



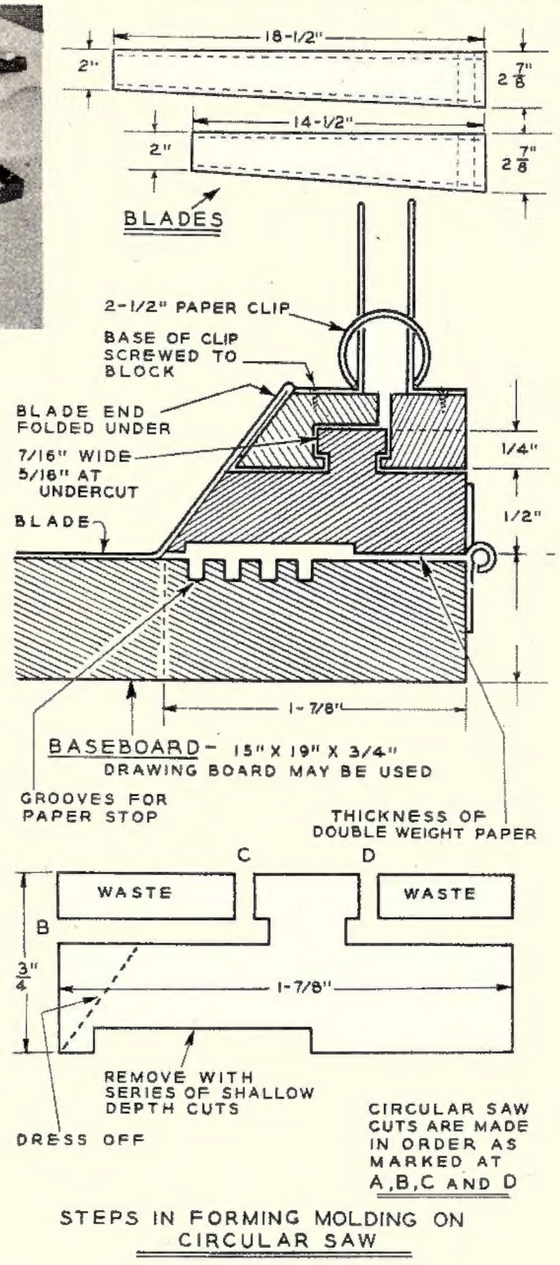
No. 1: The completed board. The piece of white paper is used to focus upon; it may be discarded when it becomes soiled.

PHOTOGRAPHIC papers used in enlarging are most unruly, when one tries to make them stay flat. The illustrated board, however, will hold them well, and, at the same time permit the making of prints with various sized, clean-cut white borders. The board shown here can easily be made by anyone having a small circular saw available, and at exceedingly small cost.

The baseboard should be made from well-seasoned material; a small drawing board, procurable at small cost, will serve this purpose excellently. Before starting to make the molding, which forms the try-square like hinged angle, give the circular saw blade a little extra set, if it is of thin gauge, till it will make a kerf $\frac{3}{32}$-inch wide. It will now do all the grooving required with but one cut to the groove. The method of making the molding is shown on the sketches at the right. Well-seasoned birch is preferable for this part, as it is tough, yet not too brittle. After roughing out the mold, dress it down with a rabbit plane (set very fine) and sandpaper. The slot tenon joint is also formed at the saw, while the track portion and bevel are hand mitered to fit. When glueing up see that the angle be held perfectly square on its inner margin.

The grooves for the paper stops are cut as shown on the saw, after the corner at which the angle is to be fitted is made square by setting the rip-fence and saw blade and then running side and end in turn over the saw, for each groove.

The paper clips will have to be taken apart, for drilling, bending and attaching to the small clamp blocks. When bending the two blade sections of the clips avoid too sharp a corner, as they are fairly brittle. If they do



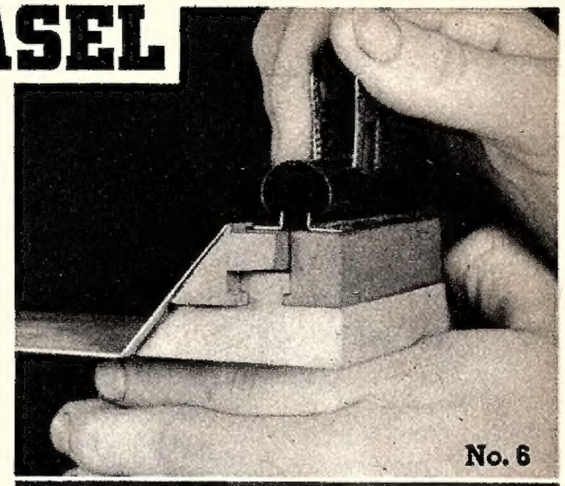
STEPS IN FORMING MOLDING ON CIRCULAR SAW

crack, they may be reinforced with solder. When the clamp blocks are attached, reassemble the clips and slide them on the molding track. The mask blades may now be secured (see photo 4). Fix the center screw and adjust with a square as shown before fixing the rest. These blades, if made from medium heavy sheet metal (about 26 gauge) need not have the edges turned under; rather have a tinsmith cut them to shape on his squaring shear. This will leave them with good straight edges that require only smoothing down the sharp corners.

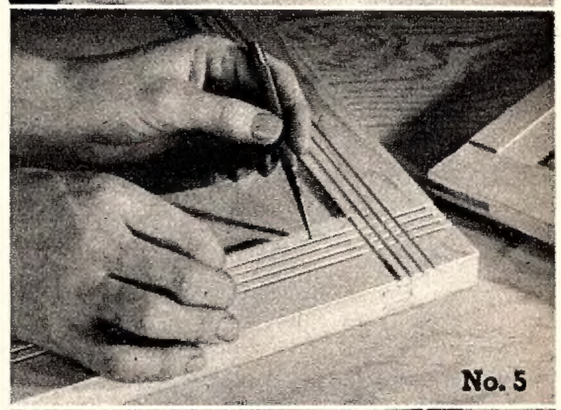
Fit small rippings, forming the paper stops, into the grooves in the baseboard so that they may be easily removed with the fingers. These strips, the grooves and the track section of the molding should not receive paint. One or two thin coats of shellac will prevent them soiling and at the same time avoid clogging them up with pigment. While the baseboard may be finished white for focusing, it is probably just as well to paint it mat-black along with the blades and mold, using a white paper for focusing; this may be discarded when it becomes soiled.

A little paraffin rubbed along the sliding portions when using the board will lessen any catchy friction that might be present the first time the easel is used.

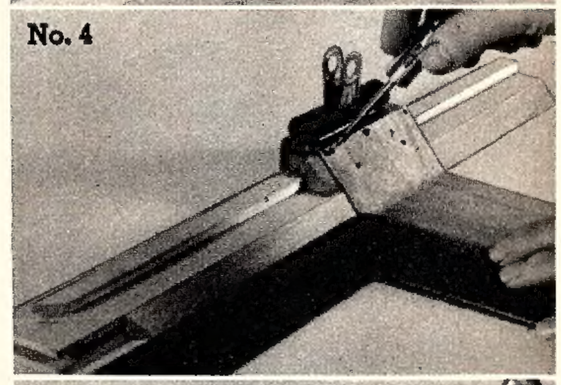
It is not necessary to clamp this easel to the enlarger base. Its own weight will keep it in place while exposures are being made. Small rubber "bumpers" on the under side will make good friction feet.



No. 6

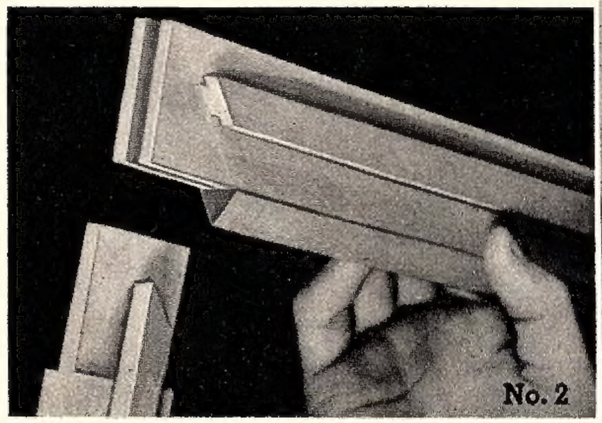


No. 5

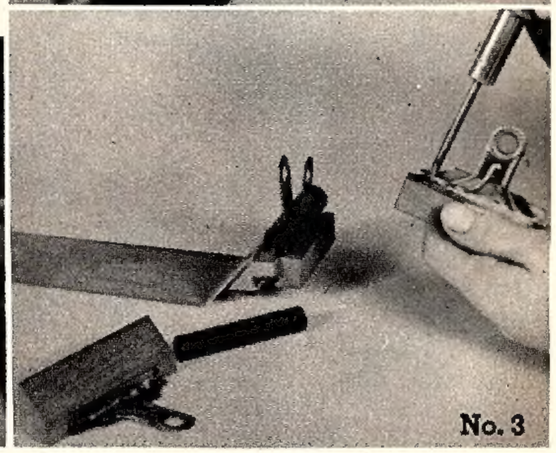


No. 4

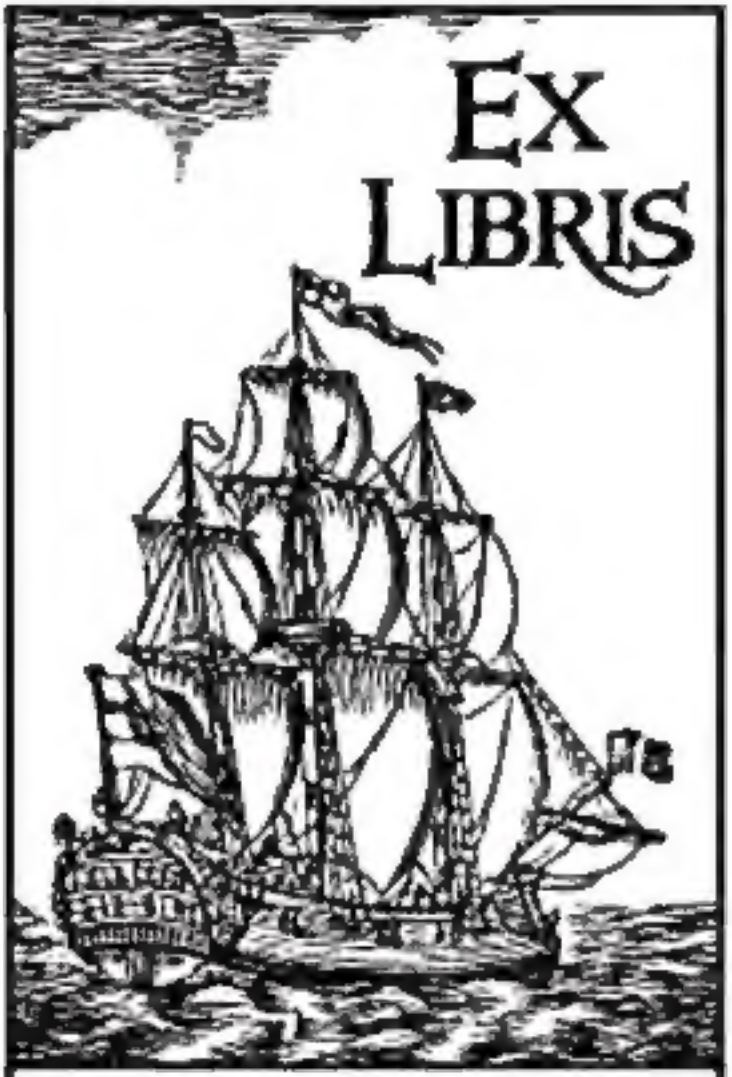
No. 2: The molding with joint fitted; ready to be cleaned up. When assembling see that this portion is glued up square. No. 3: Showing how the clips are formed to make the clamps for the masking blades. No. 4: When attaching the blades to the clamp blocks do it in this manner, keeping the masking blade at true right-angles to the moulding edge. No. 5: Showing how the paper stops fit into the grooves, thus providing for several widths of margins. No. 6: A close-up of the clamp and the molding. Note how the clamp-blocks fit around the track.



No. 2



No. 3



Anon. Malefactor